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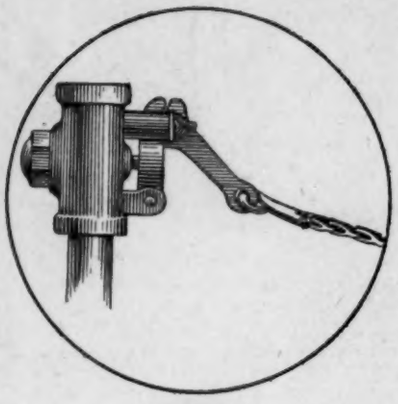

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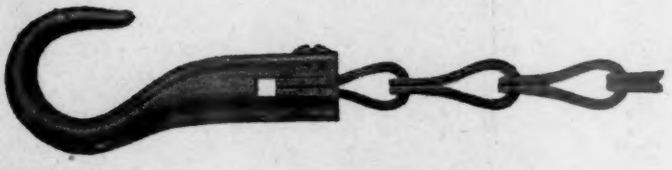

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EDITORIAL

Railway Age

DAILY EDITION

Automatic Train Control

The Committee on Signals and Interlocking of the American Railway Engineering Association submitted as information a comparative statement of the definitions and requisites that have been adopted by different committees and associations for automatic train control devices. The importance placed on these devices by the passage of the transportation act makes it essential that serious consideration be given to this subject by all railway officers having charge of departments which may be affected by the installation of such safety devices. The departments affected by these installations will be the signal, mechanical, maintenance of way and operating departments. The maintenance of way department will be affected because of the location of roadside apparatus along the right-of-way which will affect the clearance. It is important that a careful study be made of the requisites shown as information by the committee, because installations which may be ordered by the Interstate Commerce Commission under the provisions of the new law will likely be based in a general way on those shown in the report submitted. The next five years will witness increased activities in this direction, which will make it necessary for the officers in all of the departments affected to make a careful study of the subject.

The Wheel That Makes the Noise Gets the Grease

The American Railway Engineering Association has established a most enviable reputation in professional circles the world over. Recognition has been repeatedly accorded its officers in this country through their selection for important public and corporate positions. From a review of the facts presented by President Stimson in his address, there is no question but that the American Railroad Association considers the American Railway Engineering Association one of its most valuable sources of help in effecting the unification and improvement of railway practices. But why keep all these things a secret from the public? Year after year the conventions have been held in Chicago with but the barest notice in the daily press, notwithstanding the fact that many organizations far less important have received extended publicity. Newspaper space is not a form of emolument granted for special merit in modesty; it is secured only by going after it—intelligently. That it is forthcoming in return for properly directed effort is witnessed by the publicity given to the one-day railroad meeting of the American Association of Engineers, a young organization that lays no claim at this time to the standing enjoyed by the American Railway Engineering Association after 21 years of useful life. Yet it is safe to say that ten persons have heard of the American Association of Engineers to one that knows of the American Railway Engineering Association. Nor is publicity a thing to be despised. Engineers owe it to themselves to improve their standing in the community. The general dissemination of facts concerning the fruits of their united efforts is one means of attaining that end. Publicity is a prime requisite to a healthy growth in membership. The American Railway Engineering Association must come out of its shell.

Get an Early Start

The advantage of organizing the committee work as promptly as possible after the closing of the convention has been touched upon editorially so often that it has become rather trite and we hesitate to refer to it again. However, the tardiness of this year's committee report bulletins recalls the subject so emphatically that it warrants further consideration. A number of the reports contained matter that could not be discussed intelligently without thorough study and the inability of the members to do this had an adverse effect on the discussion. This was notably the case in the comments on the new specifications for rails and several of the speakers expressed their regret at not being able to do the subject justice because of inadequate preparation. It is but fair to state that the delay in the issuance of the bulletins this year was not entirely the result of the tardy completion of the committee reports. The secretary was confronted with unusual conditions both in the printshop and in the mail service, which probably will not exist next year. However, the argument for the prompt prosecution of the committee work still holds. Most of the chairmen get their committees to work as soon as the names of the committeemen are announced, but they should not be handicapped by the delay in the completion of the personnel or in the assignment of the work.

The Difference in the Morning

Discussion at association conventions is not always the truest indication of the worth of a committee report. Although straws show which way the wind blows, there are various circumstances which may affect the consideration of committee work. The present convention has been no exception in this regard. The weather observer has noted all the atmospheric conditions at the sessions from absolute calm, gentle zephyr, variable wind, and hard straight storm to the real twister which has a definite storm center. Wednesday afternoon's session was prolonged to quick dressing time by the lively discussion of the report of the committee on rules and organization, especially that part of the recommendations which referred to instructions to bridge inspectors on testing rivets and the manner of reporting the conditions of steel structures. The session was ended only on decision to continue discussion Thursday morning.

When this committee was recalled Thursday morning, the recommendations, which were rather long, were read in their entirety by the chairman and an affirmative vote obtained on their adoption, with the dissent of only one member who had attended during the previous afternoon discussion.

One of the great privileges of the association is the opportunity for free discussion on the floor of the convention. All standing committees and their chairmen recognize and welcome constructive discussion of reports, for it serves as a guide to them in their work. Organization among the leaders on the floor is a heavy responsibility demanding intensive preliminary work, but it is well worth while to pick up a discussion where it has been dropped in case of such unavoidable interruptions, for the character of the matter placed in the Manual is the medium through which the worth of the association is made known to the world.

Members, Old and New

THE HIGH STANDING OF THE American Railway Engineering Association is due directly to the individual sacrifices continually made for the good of the profession by its many active members, to the excellence of its organization, and to its admirable system of handling reports. There are few professions whose members have less leisure time than the engineer officers of our railways, to whom each succeeding year of the past decade has left its legacy of added duties. Yet their devotion to association matters has never wavered and is quite as marked today as ever before.

The world has recently passed through its greatest war, which we are told was essentially an engineers' war, and is now, let us hope, entering upon its greatest era of peace, which bids fair to be an engineers' peace, for our industrial progress in competition with other nations is as intimately dependent on the engineer and his skill, as were the preparations for the great drives which changed the fortunes of nations and the map of Europe in the late unpleasantness overseas.

The world applauded with dawning astonishment the military achievements of the civilian volunteer railway engineer. It now beholds him with much the same regard assuming the new burdens of peace time, pyramided on all the old ones; adjusting himself to each succeeding emergency, and pursuing the even tenor of his way, carrying on as usual in peace as in war. Amid all the unrest of men the work of the American Railway Engineering Association has been continued, despite the enforced absence of those of its members who were chosen to help in winning the war, while those active members who remained in American railway employ redoubled their efforts for the association at an expense of personal sacrifice known only to themselves. The returned volunteers, again settling in railway engineering service, feel the need of the benefits of the association which are always greatest to those who are most active in its affairs. Their memberships are solicited because they have proved their worth as men of wisdom and action.

The secret of the success of engineers, where at times other men fail, appears to be their resourcefulness in emergencies, which is made possible by that practical knowledge of applied science which gives absolute confidence in personal ability. The engineer knows conditions and knows his own strength as he knows the strength of the materials with which he builds. With a membership composed of men of this stamp who annually choose as leaders a number of their most skilled organizers, there is every reason to believe that the A.R.E.A. is far from the zenith of its power for the good of the profession. No young engineer can afford to withhold his name from its membership, nor his attention from the activities which contribute to the solution of its problems.

Few engineers, fortunately, are orators; on the other hand, many of the younger men and some older ones are diffident before audiences, especially before those which include their superiors. This modesty keeps many a member in his seat and prevents much instructive oral discussion in the convention hall. In the course of a convention too few written discussions are presented; here is a valuable alternative available to the modest member, for a written discussion needs seek no parliamentary opportunity. It affords the author time for research, study and composition, and is appreciated on the floor of the convention as evidence of thoughtful application and well ordered presentation. The young engineer is by no means at the end of his resources if he cannot attend conventions or speak freely to engineering audiences. The avenue of written discussion is open to all and at present is by no means crowded.

Registration for the Convention

According to a statement by President Earl Stimson of the American Railway Engineering Association at the closing session, the registration of members and others attending the convention was 563, this total being 100 more than that reported in any previous year.

Record Attendance at the Coliseum

The attendance at the National Railway Appliances Exhibit up to noon yesterday totaled 3,200, which, considering the early adjournment of the A. R. E. A. convention, indicates a large total attendance for the day. The final totals for Monday, Tuesday and Wednesday, respectively, were 2,079, 8,553 and 8,129. The number attending on Tuesday is the record attendance in the history of the association. The maximum attendance previous to this occurred on Tuesday of the 1916 show, when 7,716 visitors passed through the gates.

Dress Up the Poor Kid!

Three years ago when Committee XXII submitted its initial report on Economics of Railway Labor, C. E. Lindsay christened the new committee as the twenty-second child of the family and a lusty infant. The compliment was received with due appreciation and the applause of the convention. But this committee never seems to be able to get its illustrations printed in the bulletins. There never is a chance to really give them the needed space for either plans or pictures.

Twenty-two is a large family. When Ma gets herself ready for the meeting after seeing to all the children, she has her work cut out to put the house in order before the bell rings, and she expects the children to sort o'help each other get buttoned up. That engraver girl next door helps sometimes, too. But this year, with getting the biggest girls dressed up in all their finery of new designs and frills, she entirely forgot the latest born—and when in despair she ran to Ma with the child in her arms, Ma threw up both hands and cried, "Laws, if there ain't that baby again without anything to put on. Well, cloes is cloes, and I spent too much on the oldest girls this year again. Young ladies when they come out just have to have the best and it does cost money these days.

"There ain't no money an' there ain't no time to tog out that baby. Wrap the poor kid up in th' same old blanket an' keep it from squallin' if you kin, but mind them pins today, or he'll yell right out in meetin'."

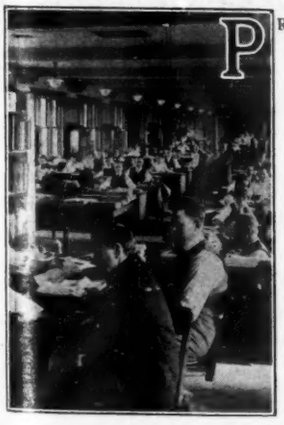
Isn't it about time that this kid had something to wear that we could call real clothes?

Railway Engineering Association Proceedings

An Account of Thursday's Sessions, Including a Presentation of Eight Committee Reports and Closing Business

THE TWENTY-FIRST ANNUAL CONVENTION of the American Railway Engineering Association drew to a close on Thursday at 3 p. m. The morning session was called to order at 10 o'clock by President Stimson. The report on Rules and Organization, which was carried over from the preceding day, was first disposed of, after which reports were presented on Rail; Records and Accounts; Yards and Terminals; Signals and Interlocking; Signs, Fences and Crossings; Economics of Railway Operation; Economics of Railway Labor, and Standardization. These were followed by routine business and the installation of the new president, H. R. Safford. Abstracts of the reports and the discussions are given below.

Report on Records and Accounts



PROPOSED CHANGES IN the Manual are given in Appendix A.

A report on cost-keeping methods and statistical records, and a report on forms for analyzing expenditures for assistance in controlling expenditures was given in Appendix B of the committee's report.

In Appendix C of its report the committee presented forms for maintenance of way and structures, for construction and for records; and recommended their approval for publication in the Manual.

Committee: W. A. Christian (I. C. C.), chairman; M. C. Byers (W. M.), vice-chairman; Lester Bernstein (Philadelphia Co.), H. Borton (Cons. Engr.), J. W. Fox (C. of Ga.), B. B. Harris (Cons. Engr.), G. T. Kuntz, Henry Lehn (N. Y. C.), J. H. Milburn (B. & O.), R. C. Sattley (C., R. I & P.), H. M. Stout (N. P.), W. D. Wiggins (P. L. W.).

Appendix A—Revision of Manual

The committee recommended that all forms, in so far as practicable, be made correspondence size—that is, 8½ in. by 11 in.

That all forms be printed in one color, black, and that on forms intended for office use to be filled in with typewriter, horizontal lines be omitted; forms intended for field use to have horizontal lines provided.

That bridge department forms now in the Manual be rearranged in logical order, and the descriptive matter placed immediately under the form to which it pertains.

That all forms relating to cost data or authority for expenditure be developed so as to comply with revised Federal Order No. 3, pertaining to extensions, improvements or changes in the physical property of common carriers.

Forms 701, 1100, *pp.* 345 *and* 346—The printing on the back of this form and instructions as to use to be shown as a footnote at bottom of form.

Forms 703 *and* 704, *pp.* 349 *and* 350—Form 703 to be withdrawn and combined with 704, making following changes in the latter: Omit "General" in title of form; omit "General" before the word "Condition" in fourth line and insert after the word "required" the words "action taken or."

Form 702, *page* 352—It was recommended that this form be issued in the form of a postal report, on manila cardboard, four inches by six inches in size, addressed on the reverse side to the proper official.

Form 1103, *pp.* 353 *to* 356—It was recommended that this form be changed to show "Time" and "Overtime"; that the form be printed in the Manual full size, that is, five inches by eight inches, including the printed instructions, as now shown in the Manual.

Form 2202, *page* 384—It was recommended that the following changes be made in this form: Size of form to be 11 in. by 24 in.; change "Sub-Section" to read

"Valuation Section"; in column 4, State and County to be reversed; in column 5, omit the word "School"; in columns 8 and 9, omit horizontal line under "AFC" and "Contract"; in column 11, substitute "length of service" for "Indicate Age"; in columns 12, 13 and 15, substitute "December 3" for "June 30."

Form 2001, *page* 388—Add paragraph reading "A receipt in full shall be required for each lease or contract removed from the files."

General—It was further recommended that the specifications and instructions for the use of the several forms be grouped at the end of each particular group, instead of placing the information with each form.

Form 2000, *pp.* 385, 386—Inasmuch as carriers are required by the Interstate Commerce Commission to file schedules on forms DV 107 and 108, as prescribed by Federal Order No. 7, and as these returns comprise practically all the data called for on form 2000, "Register of Title Deeds," it was considered unnecessary to retain this latter form, but in lieu thereof to keep up forms DV 107 and 108 to date. It was therefore recommended that form 2000 be withdrawn from the Manual.

Forms 1110 *and* 1111, *pp.* 396 *and* 379—It was recommended that form 1110, "Monthly Report of Expenditures," and form 1111, "Record Cost of Work," be made 8½ in. by 14 in. and changed to conform with forms designated as Exhibits B and C.

It is suggested that the forms in the Manual be shown without the initials "A. B. & C. R. R.," and in lieu thereof a blank line with the words "Name of Railroad" be inserted.

Forms 1107, 1108, 1109, *pp.* 391-394—After careful study of these forms, the committee recommended their withdrawal and that a form designated as Exhibit D be substituted.

Discussion

W. A. Christian (chairman) presented the report. After reading the matter contained under "Appendix A—Revision of Manual," he moved that the recommended changes be adopted for inclusion in the Manual.

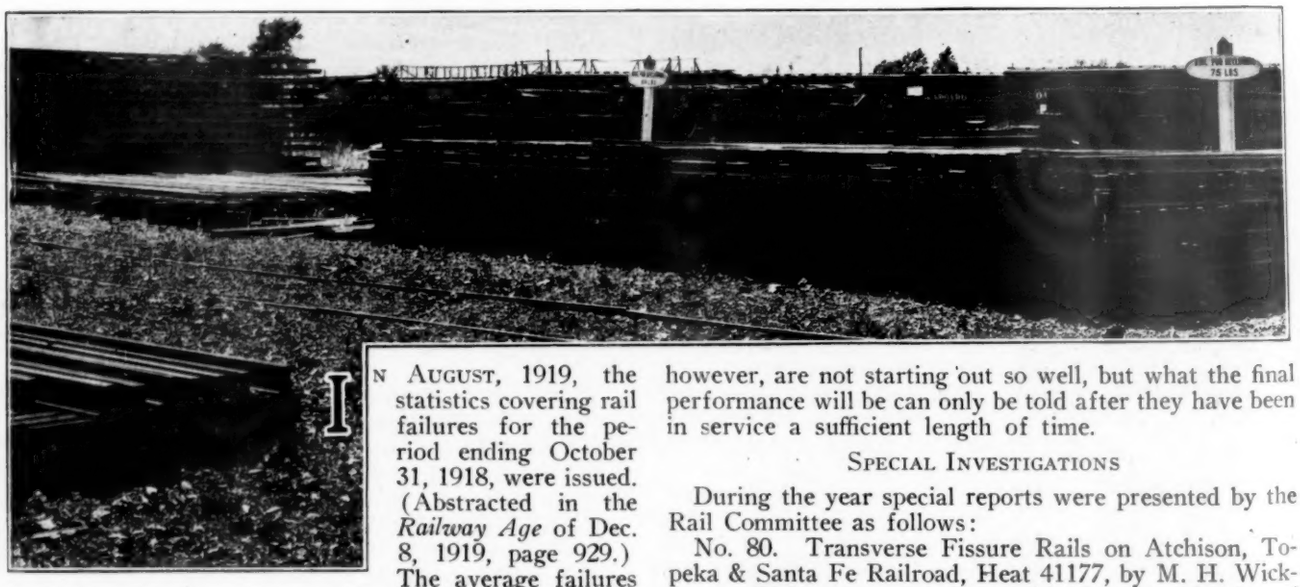
(Motion seconded and carried.)

That portion of the report on "Forms for Maintenance of Way and Structures" was presented by H. M. Stout (chairman of sub-committee), and after some explanation Mr. Christian moved that the matter as presented be approved for inclusion in the Manual.

(Motion seconded and carried.)

(The committee was excused with the thanks of the association.)

Report of the Committee on Rail



IN AUGUST, 1919, the statistics covering rail failures for the period ending October 31, 1918, were issued. (Abstracted in the *Railway Age* of Dec. 8, 1919, page 929.) The average failures per 100 track miles of the rollings for the several years, including both Bessemer and open-hearth rails, are given herewith. This summary includes statistics from the reports for the years 1913 to 1918, inclusive:

Year Rolled	Years' Service 0	1	2	3	4	5
1908	...	....	....	.....	.....	398.1
1909	...	....	....	.....	224.1	277.8
1910	...	....	....	124.0	152.7	198.5
1911	...	....	77.0	104.4	133.3	176.3
1912	...	28.9	32.1	49.3	78.9	107.1
1913	2.0	12.5	25.8	44.8	69.5	91.9
1914	1.2	8.2	19.8	32.9	50.9	.....
1915	0.7	8.9	19.0	34.2	.....	.....
1916	1.6	11.8	29.2	.....	.....	.....
1917	5.3	21.6	....	.....	.....	.....
1918	1.6	....	....	.....	.....	.....

It will be noted that the 1908 to 1913 rollings show successively decreased numbers of failures compared on a basis of five years' service, and the 1914 rolling shows a further decrease when compared on a basis of four years' service. The more recent or "war-time" rollings, however, are not starting out so well, but what the final performance will be can only be told after they have been in service a sufficient length of time.

Special Investigations

During the year special reports were presented by the Rail Committee as follows:

No. 80. Transverse Fissure Rails on Atchison, Topeka & Santa Fe Railroad, Heat 41177, by M. H. Wickhorst. This paper gave the results of an examination of 52 rails all of one heat. The conclusion from this work was that transverse fissures are a development of small cracks existing in the interior of the rail head. Some of the rails of the heat were in a "shattered" condition in the interior, containing numerous small interior cracks, a few of which developed in service forming fissures.

No. 81. Rail Failure Statistics for 1918, by M. H. Wickhorst.

No. 82. Intensity of Pressure on Rails, by sub-committee, J. R. Onderdonk, chairman.

No. 83. Are the Nuclei of Fissures Cracks? by M. H. Wickhorst. This paper describes a few heat-treating experiments, the results of which support the idea that the nuclei are cracks from which fissures developed.

No. 84. Examination of Rails Long in Service for Relation Between Internal Stresses and Strains and Transverse Fissures, by W. C. Cushing. This paper gives the results of tests of some old Bessemer rails which

showed high internal stresses but in which no fissures were disclosed.

No. 85. The Nature of the Defects Revealed by the Deep Etching of Tranversely Fissured Rails, by Henry S. Rawdon. This paper describes some skillful work done by the Bureau of Standards at Washington, which showed that the "etching cracks" found in certain rail sections by deep etching with strong acid, result from pre-existent cracks (that is, previous to etching), the acid opening them up and rendering them visible.

No. 86. What Is Brittleness in Steel Rails? by M. H. Wickhorst. This paper is a discussion of the nature of brittleness in rails and the underlying causes for it.

No. 87. Review of Work on Interior Transverse Fissures, by Dr. P. H. Dudley.

Specifications for Steel Rails

Last year the committee submitted revised specifications for steel rails for consideration during the year. The committee has been in consultation with the rail manufacturers both by correspondence and in two joint meetings, and in this way has received their views and comments on the proposed specifications. In Appendix A were submitted Specifications for Carbon Steel Rails for adoption by the Association. A number of changes have been made from the specifications at present in the Manual, all of which should be given careful thought, but mention may be made of the following:

(a) For open-hearth rails 111 lb. per yard and over, the carbon is made 0.67 to 0.82 per cent, an increase of 0.05 per cent for the heaviest class of rails.

(b) For open-hearth rails the acceptance analysis is made on a sample from the finished rail instead of the ladle test ingot.

(c) For open-hearth rails the carbon range or spread is made 0.15 per cent instead of 0.13 per cent, it being felt slightly more allowance may be made when analyzing the finished rail.

(d) The bending of the rail in the physical testing may be accomplished by either the drop test or the quick bend test (hydraulic bender) as agreed upon in the contract.

(e) The elongation is required to be at least eight per cent in one inch of six inches.

(f) Three test pieces for bending are selected from each heat of open-hearth rails and all three must meet the requirements.

Intensity of Pressure

Two years ago the committee presented the results of tests made on the reciprocating wheel load machine at Sparrows Point, Md., dealing with the crushing effect on rail metal of various wheel loads. The rails so tested were later put into track and the observations continued. A final report of this work was given in Appendix D, which illustrates the displacement of the metal around the small test holes drilled through the rail head from side to side. Photographs of sections through the holes and microphotographs of etched sections were also given. These showed that while the vertical diameters of the holes had in all cases diminished more than the horizontal ones, the evidence of slip or flow was closely confined to the horizontal axes.

The results were given of New York Central experiments of area of contact between wheel and rail, which indicate that moderate unit pressures may be expected where rail and wheel conform, but where this is not the case, very severe kneading of the steel in the head of the rail may be expected.

Drilling of Rails

The Manual contains recommended spacing for bolt holes lengthwise of the rail. The committee submits the following recommendations for further standardizing the drilling:

1. That the distance of bolt holes above the base of the rail shall be such that the center line of the bolt holes shall be in the horizontal plane midway between the intersections of the vertical center line of the rail with the planes of the fishing surfaces of the head and base.

2. That the end clearance between adjacent rails, bolted in normal position, shall be $\frac{1}{8}$ in.

3. That for standard rails up to 120 lb. per yd., a one-inch bolt and a $1\frac{1}{16}$-in. bolt hole shall be used.

4. That for standard rails 120 lb. per yd. and over, a $1\frac{1}{8}$-in. bolt and a $1\frac{3}{16}$- bolt hole shall be used.

The following table shows the recommendations as applied to the four standard rails shown in the Manual and to three A. R. A. sections:

Weight of Rail, Lb.	Type of Rail.	Height of Bolt Hole Above Base of Rail, Inches.
100	RE	2 11/16
110	RE	2 13/16
120	RE	2 15/16
90	RA-A	2 19/32
90	ARA-B	2 11/32
100	ARA-A	2 3/4
100	ARA-B	2 1/2

Conclusions

The committee submitted the following recommendations:

1. That the specifications for carbon steel rails submitted with this report be adopted by the Association and included in the Manual.

2. That the recommendations for rail drilling submitted with this report be adopted by the Association and included in the Manual.

Committee: G. J. Ray (D. L. & W.), chairman; H. B. MacFarland (A. T. & S. F.), vice-chairman; E. E. Adams (U. P.), A. S. Baldwin (I. C.), W. C. Barnes (U. P.), W. C. Cushing (P. R. R.), G. M. Davidson (C. & N. W.), Dr. P. H. Dudley (N. Y. C.), J. M. R. Fairbairn (C. P. R.), L. C. Fritch (C. R. I. & P.), J. H. Gibboney (N. & W.), A. W. Gibbs (P. R. R.), John D. Isaacs (S. P.). Howard G. Kelley (G. T.), R. Montfort (L. & N.), A. W. Newton (C. B. & Q.), J. R. Onderdonk (B. & O.), H. R. Safford (C. B. & Q.), F. S. Stevens (P. & R.), R. Trimble (P. R. R.), F. M. Waring (P. R. R.), M. H. Wickhorst.

Appendix A—Specifications for Carbon Steel Rails

Inspection

1. **Access to Works.** No change.
2. **Place for Tests.** No change.

Material

3. **Material.** No change.

Chemical Requirements

4. **Chemical Composition.** The chemical composition of the steel, determined as prescribed in section 6, shall be within the following limits:

Constituent	Bessemer Process (Limits per cent) Weight in lb. per yard		Open-Hearth Process (Limits per cent) Weight in lb. per yard		
Elements	70-84	85 and over	70-84	85-110	111 and over
Carbon	0.40 to 0.50	0.45 to 0.55	0.53 to 0.68	0.62 to 0.77	0.67 to 0.82
Phosphorus, not to exceed	0.10	0.10	0.04	0.04	0.04
Manganese	0.80 to 1.10	0.80 to 1.10	0.60 to 0.90	0.60 to 0.90	0.60 to 0.90
Silicon, not less than	0.10	0.10	0.10	0.10	0.10

5. **Average Carbon.** No change.

6. **Analyses.** In order to ascertain whether the chemical composition is in accordance with the requirements, analyses shall be furnished as follows:

(A) Bessemer Process.—No change.

(B) Open-Hearth Process.—(a) Finished Rail Analysis. On each heat the manufacturer shall make an analysis of the elements, carbon, manganese, phosphorus, sulphur and silicon. A copy of the results shall be given to the inspector.

Drillings for these analyses shall be taken longitudinally of the rail with a one-half-inch drill, close to an upper corner of the head from any one of the three drop test pieces representing the top of the ingot, or from pieces cut adjacent to any one of these three drop test pieces.

(b) Ladle Analyses.—For the information of the inspector the manufacturer shall furnish a chemical analysis of the elements, carbon, manganese, silicon, phosphorus and sulphur, for each heat. These analyses shall be made on drillings taken from the ladle test ingots not less than one-eighth inch beneath the surface.

(C) Check Analysis.—On request of the inspector, the manufacturer shall furnish a portion of the ladle test ingot for the Bessemer process and a portion of the drillings from the finished rail for the open-hearth process for check analysis. When made a part of the contract the manufacturer shall furnish the necessary facilities at the mill for the purchaser's representative to make the check analysis.

(D) When the analyses for carbon by the mill chemists and by the railroad chemist do not agree, a tolerance of two points below the minimum and two points above the maximum will be allowed to cover such variation before condemnation.

Physical Requirements

7. **Physical Qualities.** No change.

8. **Method of Testing.** The physical qualities shall be determined by:

(a) The Drop Test, or

(b) The Quick Bend Test, if made a part of the contract.

9. **Drop Testing Machine.** The drop testing machine used shall be the standard of the American Railway Engineering Association, the essential points of which are:

(a) No change.

(b) No change.

(c) No change.

(d) The spacing of the supports between centers shall be: 3 ft. for rails weighing 110 lb. or less per yard, and 4 ft. for rails weighing from 111 to 140 lb. per yard, inclusive.

10. **Machine for Quick Bend Test.** The quick bend test shall be made with a hydraulic press of not less than 350 tons capacity, some of the details of which are as follows:

(a) The foundations for the supports of the test specimens shall be adequate to sustain rigidly the total load applied by the press.

(b) The supports shall be solid flat bearing surfaces with vertical faces 48 in. apart, with the inner edges rounded to a ⅛-in. radius.

(c) The head of the ram shall have a bearing face with a radius of five inches.

(d) The speed of the ram shall approximate 13 ft. per minute when allowed free travel.

(e) A hydraulic indicator shall be connected with the press so that the pressure on the head of the ram is registered by the pen arm on a vertical scale, and the distance rotated by the cylinder shall be proportional to the travel of the ram head.

11. **Test Specimens.** (a) Test specimens shall be one or two feet longer than the span between supports in the testing machine.

(b) Test specimens shall be cut from the crop of the top rail of the ingot, and marked on the center line of the top surface of the head with gage marks one inch apart for three inches each side of the center of the specimen, for measuring the ductility of the metal.

(c) Where it is necessary to test rails lower than the first rail, the bottom of the first rail, in lieu of the top of the second rail, and the bottom of the second rail, in lieu of the top of the third rail, will be accepted, if preferred by the manufacturer.

(d) The temperature of the test specimens shall be between 60 and 100 deg. F.

(e) Unless otherwise instructed by purchaser, the test specimens shall be tested with head in tension and with the center punch marks midway between supports.

12. **Height of Drop.** The test piece shall be subjected to impact of the tup falling free from the following heights:

For 70 to 79 lb. rail, incl.....16 ft.
For 80 to 90 lb. rail, incl.....17 ft.
For 91 to 110 lb. rail, incl.....18 ft.
For 111 to 140 lb. rail, incl.....20 ft.

13. **Elongation.** Under these impacts the rail under one or more blows shall show at least 8 per cent elongation for one inch of the six-inch scale, marked as described in Section 11 (b).

(b) If any test piece does not show the required elongation (Section 13), or if when broken shows interior defect, all of the top rails from that heat shall be rejected.

(c) Second tests shall then be made from three test pieces selected by the inspector from the top end of any second rails of the same heat, preferably of the same ingots. If all these test pieces show the required elongation (Section 13), all of the remainder of the rails of the heat shall be accepted, provided that no test piece, when broken, shows interior defect.

(d) If any test piece does not show the required elongation (Section 13), or if when broken shows interior defect, all of the second rails of the heat shall be rejected.

(e) Third tests shall then be made from three test pieces selected by the inspector from the top end of any third rails of the same heat, preferably of the same ingots. If all these test pieces show the required elongation (Section 13), all of the remainder of the rails of the heat shall be accepted, provided that no test piece, when broken, shows interior defect.

(f) If any test piece does not show the required elongation (Section 13), or if when broken shows interior defect, all of the remainder of the rails from the heat shall be rejected.

19. **No. 1 Rails.** No change.

20. **No. 2 Rails.** Rails which vary from specifications in a manner which does not impair their soundness and strength will be accepted as "No. 2 Rails." The rails to be so accepted are as follows:

(a) Rails arriving at the straightening process with sharp kinks or greater camber than that indicated by a middle ordinate of 4 in. in 33 ft. for the thick base sections, and 5 in. for the thin base sections.

(b) Rails which do not contain surface imperfections in such number or of such character as will, in the judgment of the inspector, render them unfit for recognized No. 2 uses.

Rails accepted as No. 2 rails shall have the ends painted white, and shall have two prick punch marks on the side of the web near the heat number, near the end of the rail, so placed at not to be covered by the joint bars.

No. 2 rails to the extent of five per cent of the whole order will be accepted.

Details of Manufacture

21. **Quality of Manufacture.** No change.

14. **Exhausted Ductility Test.** A sufficient number of blows shall be given to determine the complete elongation of the test piece of at least every fifth heat of Bessemer steel, and of one out of every three test pieces of a heat of open-hearth steel.

15. **Permanent Set.** For each specimen, a record shall be made of the permanent set, measured on a 3 ft. chord, after each blow under the drop test.

16. **Test to Destruction.** No change.

17. **Bessemer Process Physical Tests.** One piece shall be tested from each heat of Bessemer steel.

(a) If the test piece shows the required elongation (Section 13), all the rails of the heat shall be accepted, provided that the test piece when broken does not show interior defect.

(b) If the test piece does not show the required elongation (Section 13), or if when broken shows interior defect, all of the top rails from that heat shall be rejected.

(c) A second test shall then be made of a test piece selected by the inspector from the top end of any second rail of the same heat, preferably of the same ingot. If the test piece shows the required elongation (Section 13), all of the remainder of the rails of the heat shall be accepted, provided that the test piece when broken does not show interior defect.

(d) If the test piece does not show the required elongation (Section 13), or if when broken shows interior defect, all of the second rails from that heat shall be rejected.

(e) A third test shall then be made of a test piece selected by the inspector from the top end of any third rail of the same heat, preferably of the same ingot. If the test piece shows the required elongation (Section 13), all of the remainder of the rails of the heat shall be accepted, provided that the test piece when broken does not show interior defect.

(f) If the test piece does not show the required elongation (Section 13), or if when broken shows interior defect, all of the remainder of the rails from that heat shall be rejected.

18. **Open-Hearth Process Physical Tests.** Test pieces shall be selected from the second, middle and last full ingot of each open-hearth heat.

(a) If all of these test pieces show the required elongation (Section 13), all of the rails of the heat shall be accepted, provided that no test piece when broken shows interior defect.

22. **Record of Manufacture.** When made a part of the contract, the manufacturer shall furnish the inspector with a carbon copy of open-hearth or Bessemer charge sheets; records of melting, tapping, ladle and teeming conditions; soaking pit charge sheets, rolling mill operation; rail weight sheets; hot bed and straightening records, wherever such sheets or records are in regular use by the manufacturer.

23. **Bled Ingots.** Bled ingots, from the center of which the liquid steel has been permitted to escape, shall not be used.

24. **Discard.** No change.

25. **Lengths.** No change.

26. **Stool Cutting.** Care should be taken in teeming the ingots to prevent cutting out of the cast iron of the stools of ingot molds by the falling stream of hot metal from the ladle, and thus avoid a frequent cause of carbon streaks found in the finished rail.

27. **Mold Spattering.** Spattering the interior sides of the molds in pricking the heats or melts and teeming the ingots must be avoided as much as possible.

28. **Stopper Defects.** Excessive use of material thrown into the teeming ladle to set the stopper must be avoided.

29. **Aluminum.** The steel must be made to set quick by the chemical composition in the molds without the addition of aluminum, either in the ladle or molds.

30. **Time for Ingot Setting.** Time must be allowed for the tops of the ingots to set without spraying with water.

31. **Ingots Vertical.** Ingots shall be kept in a vertical position on the ingot cars and in the reheating furnaces until their heat is equalized ready to be rolled.

32. **Section.** No change.

33. **Weight.** No change.

34. **Hot Bed Work and Straightening.** (a) Care must be taken in cambering the rails and with the hot-bed work so that rails will cool with a small but uniform sweep, and therefore gagging under the presses will be reduced to a minimum.

(b) Rails while on the cooling beds shall be protected from snow, water and excessive gusts of cold wind.

(c) When delivered to the straightening presses rails shall not vary in any direction from a straight line throughout their entire length more than 4 in. for the "RE" and "RA" thick base sections, and not more than 5 in. for "ASCE" sections.

(d) The supports for rails in the straightening presses shall have flat surfaces and be out of wind, and shall be spaced not less than 42 in. The application of the gag shall be central between supports, and the overhang of either end of the rail during straightening should be supported.

(e) Rails heard to snap while being straightened shall be at once rejected.

35. **Drilling.** Circular holes for joint bolts shall be drilled to conform to the drawings and dimensions furnished by the Railroad Company. A variation of 1/32 in. in the size and location of bolt holes will be allowed.

36. **Finishing.** No change.

37. **Branding.** No change.

38. **Separate Classes.** No change.

39. **Loading.** Rails shall be carefully handled and loaded in such manner as not to injure them. When a part of the contract, all first quality rails of each heat shall be kept together in loading.

40. **Payment.** No change.

Matters Subject to Contract

Clause 3 —Steel may be Bessemer or open-hearth.
Clause 6c—Check analysis.
Facilities for analyses at the mill.
Clause 8b—The quick bend test.
Clause 22 —Record of manufacture.
Clause 40 —Loading.
Keeping rails of each heat together.

Notes on Manufacture Added as Information

(To be attached to the specification)

Note A: The selection of the ores, scrap, molten metal, fluxes and other furnace additions; regulation and quality of the port gases; condition of the slag, furnace bottom and lining; temperature of the bath, and time for refinement of each melt of steel require especial attention so that the molten steel when tapped will be refined and deoxidized.

Note B: The steel must be well deoxidized and the waste products eliminated before the ingots are teemed, and thus prevent minute portions of the deoxidation products from becoming entrained in the setting metal. Time is required for the deoxidation products and impurities to rise after the steel is tapped into the ladle.

Note C: Loose material and dirt should be removed from the ladle before tapping is commenced to prevent impurities from being incorporated in the molten metal. The ladle lining should be well set before tapping.

Attention should also be given to the proper coating of the ingot molds, and care should be taken to remove dirt or loose material from the tops of the ingot buggies before setting up the molds.

Note D: The ingots should be stripped as soon as the metal caps over on top; weighed and charged promptly into the soaking pits, and thus avoid cooling of the interior metal. This checks the shrinkage of the steel, which may be large, depending upon the volume, chemical composition and temperature of the ingot at the time it is charged. The interior shrinkage can be confined to 0.05 to 0.1 per cent per cubic foot of the metal, so that it is eliminated in the usual discard of the bloom, and helps to prevent piped rails due to cold ingots.

Note E: The ingots should be uniformly heated in the soaking pits and the port gases properly regulated to prevent overheating, and with protection from direct impingement against the vertical faces of the ingots. The large hot ingots should be soaked at least two hours before blooming.

Note F: Blooming the ingots and rolling the blooms into finished rails should all be done when the ranges of temperature for the ingots, blooms and rails are suitable for the metal to be cambered and then cooled so that the transformations and recalescence will be complete for the desired steel.

Note G: The hot rails from the saws and on the "hot-beds" should be spaced to allow the recalescence of the head to follow that of the base without being locked or blocked by adjacent rails on either side.

Note H: The effect of straightening may be materially reduced for the heavier and stiffer sections by spacing the supports in the press at 60-inch centers. Several mills have made the necessary changes with beneficial results.

Care should be taken to see that the supports of the presses are not worn hollow, and the gags used have rounded corners, and are in good condition.

Discussion

In the absence of G. J. Ray (chairman), H. B. MacFarland (vice-chairman) presented the report.

Vice-Chairman MacFarland: The work of the committee covered 13 subjects assigned for the past year. The rail failure statistics have been compiled as in the past, as has the work on special investigations. The specifications for steel rails were presented at the last meeting of the association. They will now be presented to you with the recommendation that they be inserted in the Manual.

Under rail sections, the committee desires to make a supplementary report, as it is now able to report on 150 lb. section of rail, which has been designed along the same lines as the 130 and 140 lb. rails shown in the 1915 proceedings. This rail section is submitted to the association for information only.

One of the concluding recommendations of the committee will involve the insertion of 130 and 140 lb. rails in the Manual. This will automatically cause the following insertion in the table on rail drillings: Weight of rail, 130 lb.; type of rail, R. E.; height of bolt hole above base of the hail, 3 1-16 in.; weight of the rail, 140 lb.; type of rail, R. E.; height of bolt hole above base of the rail, 3⅛ in.

I move the adoption of recommendation (1) under Conclusions. (The motion was seconded. C. G. Gennet, Jr., R. W. Hunt & Co., then read a prepared discussion, which is abstracted below.)

A common rail specification, fit for all railroads and all manufacturers, seems almost impossible of realization and the next best thing for this association is to create a high standard for the guidance of individual purchasers in their dealings with manufacturers. My principal objection to the proposed specification lies in the fact that it does not go far enough to merit the distinction intended. This specification provides no change or im-

provement of the method designed to restrict the production of split heads offered by the specification adopted in 1912. Likewise, broken rails and base failures combined, representing 41 per cent of all the failures, might be reduced by providing that certain test pieces be pickled in acid, so that opportunity for a more careful surface inspection for seams could be arranged for when conditions demanded.

Passing to the proposed specification, the first important change from present practice is with the chemical composition. My experience leads very strongly to the opinion that a few points of carbon may be greatly overshadowed by the later treatment that the steel receives. Many benefits would accrue from the adoption of a common standard for the carbon content, and as the specifications most used now vary from a minimum carbon of 0.58 per cent to a maximum of 0.76 per cent, it seems to me that the change made by this specification might be improved by making the limits, say 0.59 to 0.76 for rails of 85 lb. to 110 lb. per yard in weight. This would compose the chief differences now existing in the chemical requirements of a number of specifications, without apparent detriment to the various roads.

The most radical departure from present practice made by this specification is with respect to the physical tests. A careful reading of Sections 17 and 18 shows that rails are to be accepted on the basis of elongation only. That is (regardless of the number of test pieces that may be broken under the drop), if those pieces show 8 per cent of elongation in one inch, the rails represented may be accepted, subject, of course, to the appearance of interior defects as defined, without regard for segregation. Naturally, this annuls the test for brittleness per se that the impact of the drop has been considered to afford for many years past.

I submit to the principle that ductile rails are safe rails, but I do not believe that the danger point of ductility for rails has been sufficiently determined or that it can be properly measured, and I regard with much apprehension the acceptance of rails based on their elongation only.

Much has been written of recent years concerning the effects of cold straightening rails and section 34 will be helpful in obtaining better hot bed work. Section 36 still provides, however, that rails shall be straight in line and surface. I urge a modification of this clause to permit of accepting rails containing a uniform sweep of not over one inch in any direction, preferably, however, with the ends high.

Omission from this specification of the clause regulating the rolling temperature is, on the whole, warranted and justifiable by general mill conditions. The requirement in Section 37 (b) that the ingot numbers be stamped on rails is a distinct step forward.

A. L. Davis (I. C.): This specification has only been in the hands of the members of the association a few days, and I do not see how it is prepared to pass on it intelligently at this time.

Mr. Abbott: I would like to inquire whether or not it would be proper to ask for an explanation from the committee. There is a peculiarity embodied in this specification in regard to requirements and other matters subject to contract. There is a possibility of confusion in having that in the specification. It would seem that specifications for material should be as definite as possible; that after the committee has decided what is wanted and what they should have, it ought to be mandatory in the specification, so that anyone using it would simply have to place their order under that specification without any further question. Anyone buying rail to this specification, assuming it is adopted by the association, will immediately find themselves in an embarrassing position, because it will not be possible for them to know what the companies that are paying the most attention to rail-making require when they order, and for that reason it would seem that all this matter that is subject to agreement between buyer and manufacturer should be placed somewhere else. I think it is understood or inferred by the writers of this specification that when the statement is made and the wording is "when subject to order" or "when subject to agreement," it would be understood as operative if there was nothing of that kind in the contract. My understanding is, however, that if someone should take this or accept an order under this specification, there would be a liability of their being called on to perform everything that is mentioned, unless it was specifically mentioned in the contract that they would not do it. If this specification is approved for use, it will be necessary for the manufacturers, whenever they take an order under that specification, to specifically note in the contract the clauses and the notes, or give the part that is not supposed to be within the special agreement. My point is that it involves unnecessary work and unnecessary negotiation. If the specification should be brought down to the parts that are mandatory, that the men who have studied it and decided that those parts should be carried out, were written together, not involving any parts that are subject to contract, it would be more concise and more workable.

The chairman: So far as the subject of contract, which is the most important inclusion in the specification, this subject being referred to by Mr. Abbott, you will note that unless there was a particular agreement, that these subjects would not be taken care of by the manufacturer. If there is an agreement that you must specify in your order either Bessemer or open hearth, you may get either Bessemer or open hearth. If you want to send your own chemist to the mill, you have to make an agreement with that mill so that the chemist may go there and may have quarters. Most mills will be willing to allow this, because it would facilitate the shipment of the rail.

In reference to the quick bend test, you understand this will have to be a matter of contract. You would not get a quick bend test until you made a particular agreement for it.

Record of Manufacturer. Under that clause you would not get this record unless you made an agreement for it.

Loading: Keeping rails of each heat together. Some roads require this, but they would not get it unless they made a special agreement for it. I don't see but what this clause 40 takes care of the situation which Mr. Abbott has agitated.

Mr. Abbott: Mr. McFarland's explanation is entirely clear, and I think if the members of the committee were coming to the mills as individuals, they would find out about these things. I think all these men know what they are doing when they write those things in there, they know what they intend, but when this specification is written in full, or one or two changes made in the specification and attached to the contract, it becomes a part of the contract when the contract is signed, and the inspector coming to the mill with those specifications has instructions to see that they are complied with. My information is that he can demand what is in the specification. He may say: "I want the heats loaded separately. I want them all loaded separately on cars, so that they can be unloaded together." If the specification states that that is not to be done, the inspector is not in a position to require it to be done, and the same situation would exist in connection with other parts. There may be things in there that cannot be carried out, but it would

be part of the contract if attached to the contract. That was my reason for suggesting the possibility of separating these from the parts of the contract that are mandatory, that go along with the agreement, and that must be carried out, not leave the question open. My thought is that it would be better if all parts that are to be done as matter of contract could be arranged in the specification so that they would be absolutely cut off from the main requirements of the specification.

(The motion to adopt the specification was carried. The chairman submitted Conclusion 2 and it was accepted.)

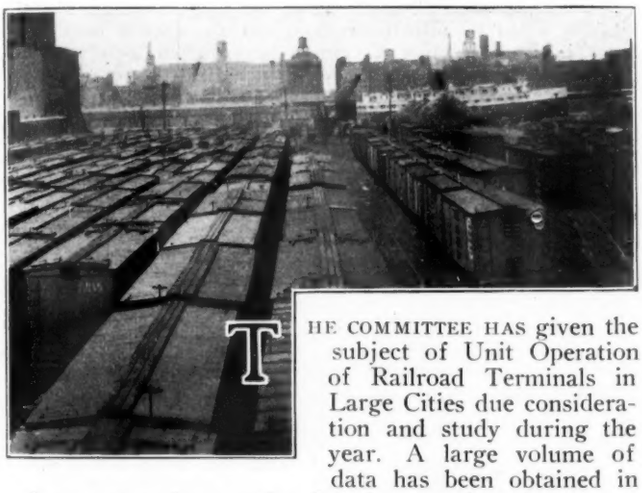
Conclusion 3, which contained the sections RE-130 and RE-140 for 130 and 140-lb. rails, as shown on pages 401 and 402, respectively, of the Proceedings of the Association for 1915, was also accepted as recommended practice, and drawings included were adopted for publication in the Manual.

The Chairman: We also offer the following conclusion:

That all the present rail forms issued as recommended practice and as shown in the Manual for 1915, pages 93 to 112, inclusive, be omitted from the new Manual, and that a statement be entered in place thereof in the new Manual, stating where the old forms can be found, and further stating that these forms are in process of revision, and will be contained in a supplement to the Manual.

(A motion to adopt was carried and the committee was excused.)

Report on Yards and Terminals



THE COMMITTEE HAS given the subject of Unit Operation of Railroad Terminals in Large Cities due consideration and study during the year. A large volume of data has been obtained in reference to unit operation, but the committee is not prepared to make a final report thereon at this time. The committee therefore reports progress and recommends a continuance of the subject.

The results of unit operation of terminals, as reported by the regional directors, during the period of Federal control, were given in Appendix C, this data having formed the basis for an article on this subject which appeared in the *Railway Age* of Jan. 2, 1920, page 77.

On subjects 3, 4, 5 and 6, respectively, handling of freight in double-deck freight houses; typical plans for passenger stations; classification yards, and small sorting yards, the committee reported progress.

Committee: B. H. Mann (M. P.), chairman; A. Montzheimer (E. J. & E.), vice-chairman; W. G. Arn (I. C.), Hadley Baldwin (C. C. C. & St. L.), Miles Bronson (N. Y. C.), G. H. Burgess (D. & H.), A. E. Clift (I. C.), L. G. Curtis (B. & O.), H. T. Douglas Jr. (C. & A.), A. C. Everham, E. M. Hastings (R. F. & P.), Reuben Hayes (Southern), D. B. Johnston (P. L. W.), H. A. Lane (B. & O.), Lt.-Col. F. E. Lamphere, F. E. Morrow (C. & W. I.), H. J. Pfeifer (T. R. R. of St. L.), S. S. Roberts, C. H. Spencer (I. C. C.), E. B. Temple (P. R. R.), E. E. R. Tratman (Engr. News), J. G. Wishart (C. R. I. & P.).

Special Assignments

At the Twentieth Annual Convention the Committee on Yards and Terminals was instructed to co-operate with a joint committee appointed by the United States Railroad Administration for the purpose of drafting "Specifications for the Manufacture and Installation of Railroad Track Scales," the committee being given power by the Association to act for it in this matter. The committee submitted in Appendix A the results of the labors of the joint committee, and recommended that the specifications contained therein be approved and substituted for the "Specifications for Track Scales," now included in the Manual. These specifications were published in the *Railway Age* of Dec. 15, 1919, page 1098.

Anticipating the approval of these specifications, it was considered desirable to also revise the "Specifications for the Location, Maintenance, Operation and Testing," to conform to the new track scale specifications. Rules covering these subjects were therefore prepared and submitted in Appendix B for approval. Approval of these rules will automatically cancel similar rules now in the Manual.

The committee was instructed to collaborate with the Committee on Water Service upon plans and specifications for typical water station layouts. Conforming to that instruction, the Committee on Water Service submitted 15 plans, showing typical terminal, passenger station, junction and yard layouts, requesting the committee to locate proposed water facilities. This was done and the plans returned to the Water Service committee.

Conclusions

The committee recommends the following action on its report:

1. That the "Specifications for the Manufacture and Installation of Railroad Track Scales" be approved and substituted for the "Specifications for Track Scales" now in the Manual.

2. That the "Rules for the Location, Maintenance, Operation and Testing of Track Scales," and the several appendices accompanying same, be approved and substituted for similar matter now in the Manual. (Appendix B.)

3. That the remainder of the report be received as information and progress.

Appendix B—Rules for the Location, Maintenance, Operation and Testing of Railroad Track Scales

SECTION I—LOCATION

1. **General Conditions.** The proper location of track scales depends principally on the following conditions:

(a) The volume of traffic to be weighed in comparison with that switched over the scales and not to be weighed. The presence of the scale in a much used track is a source of increased cost of maintenance and difficulty in inspecting and testing as well as dangerous to trainmen. In general, in yards not operated by gravity, the scale should not be located in a main drilling lead unless the number of cars to be weighed exceeds 60 per cent of the total number of cars handled or unless the total number of movements over the main drilling lead is comparatively small.

(b) Whether the scale is to be equipped with dead rail or relieving gear. If practicable, scales should be located where dead rails may be used.

(c) Whether a run around track will be installed for

switching with a separate track for weighing. Where spot weighing is done the run around track is desirable. If cars are to be weighed as classified, the weighing track need be only long enough to clear the dead rail switches. If cars are to be weighed in solid cuts, the weighing track should be long enough to hold a cut of cars to be weighed, both before and after being weighed, in order not to block operation of other tracks while weighing is being done. The weighing track may be located alongside of the drilling track, alongside of the ladder track or on an outer yard track.

(d) Whether cars are to be weighed spotted or in motion. If cars are to be weighed in motion the scale must be on a grade in the drilling track at the head of the classification yard.

(e) The cost of extra switching when the scale is not located on the lead to the classification tracks. Ordinarily the cost of the extra switching may be ignored when the integrity of the weights would be affected.

(f) The cost of maintenance when the scale is located on the lead to the classification tracks and only a small proportion of the cars are to be weighed.

(g) The necessity for quick dispatch of cars that are weighed.

2. **Position of Live and Dead Rails:** Live rails should be on the offset line and the dead rails straight unless a large portion of the cars are to be weighed. For motion weighing the offset should be divided, unless the resistance is equalized by means of a spring switch.

3. **Grade for Motion Weighing:**

(a) Runoff Grade: When the scale is located on the lead to the classification tracks in a hump yard it shall be at such an elevation that the cars will run by gravity as far as desired into the classification yard with a maximum speed of four miles per hour over the scale.

(b) Approach Grade: The distance and grade from the apex of the hump to the scale should be such that the speed of free running cars will not exceed four miles per hour on the scale without brake application; and such that cars can be so spaced and controlled that the weighing period of three seconds will not be reduced.

(c) Grade of Live Rails: Scales to be used for motion weighing should be constructed with the scale rails on a gradient not greater than one per cent. The weighing mechanism must in all cases be installed on a level plane, with supports introduced to fix weighing rails on the desired gradient.

(d) Grade for Weighing Cuts of Cars: The grade of the track for at least one car length in each direction from the scale should be the same as the grade over the scale. Where it is the practice for one car rider to take several cars together into a classification track, the same grade as on the scale should be maintained for at least 100 and preferably 200 ft. beyond the scale so that cars may be stopped easily by the car rider and so that the following cars will not cause excessive impact when striking the cars ahead. This should occur not less than one car length from the scale.

4. **Runoff Grade for Spot Weighing:** When a scale is installed not in connection with a hump, it is desirable that it be high enough to permit cars to run away from the scale by gravity after being weighed.

Section II—Maintenance and Operation

1. **Numbering Scales:** No change.
2. **Scale Shop:** No change.
3. **Cleaning:** No change.
4. **Rust Preventive for Pivot and Bearing Steels:** The best rust preventive obtainable should be applied to pivot and bearing steels, but it should be so applied as not to interfere with the proper working of the scale.
5. **Removal of Ice:** No change.
6. **Standing of Equipment Prohibited:** No change.
7. **Restrictions to Use of Live Rails:** Engines or similar heavy equipment should not be passed over the live rails, except on authority of the department having supervision over the installation and maintenance of scales. The unnecessary passing of cars over the live rails should be prohibited. Weighed cars which have passed beyond the dead rail switch must not be returned over the live rails. The dead rail switches should be set for the dead rail track except when cars are being weighed.
8. **Cars Restricted to Live Rails or Dead Rails Only:** Cars on the live rails must not be moved by cars or engines on the dead rails or vice versa. Cars must not be moved over the scale with one truck on the live rails and another truck on the dead rails.
9. **Use of Sand and Injector by Enginemen Prohibited:** Enginemen must not apply sand or use the injector when on the scale. The slipping of engine drivers on either live or dead rails is injurious to the structure and should be avoided.
10. **Weigh-beam:** The weigh-beam should be balanced before the scale is used. When not in use it should be secured by the beam catch and with the poise set at the highest graduation.
11. **Stopping Cars on Scales:** No change.
12. **Automatic Weighing and Recording:** Where automatic weighing and recording devices are used it is absolutely necessary that both the scale and the automatic devices be in first-class condition, with properly maintained approach track, and cars must be run at a slow rate of speed with particular attention to steadiness of motion which is essential to obtaining best results.
13. **Locking Scale Houses:** Scale houses and beam boxes must be kept locked when not being used.
14. **Inspection by Weighmaster:** No change.
15. **Painting:** The scale mechanism and structural steel should be painted often enough to prevent corrosion.

Section III—Testing

Paragraph 5 has been added, as follows:

5. **Adjustment:** Track scales should be kept in the closest possible adjustment, and a scale should be considered inaccurate when it cannot be adjusted, and such adjustment maintained to within 2 lb. to 1000 lb., in excess or deficiency, when distributed test is made with two or more test loads. When only concentrated sectional tests are made, the maximum error for any position of the test load should not exceed 3 lb. to each 1000 lb. of test load used.

The sensibility reciprocal of a track scale should never be more than 100 lb.

Section IV—Equipment for Testing

1. **Standard of Mass:** No change.
2. **Even Arm Balance and Master Scales:** It is desirable for verifying or scaling test weights and test cars to have, in addition to standards of mass prescribed above:

(a) An accurate even arm balance of 100 lb. capacity in each pan, sensitive when loaded to two grains.

(b) A master scale.

Section VI—Scale Test Cars

1. For general track-scale testing test cars should weigh not less than a total of 30,000 lb., nor more than 80,000 lb. For making graduated tests and to simplify computations, cars weighing 80,000 lb. and 40,000 lb., respectively, are suggested. The maximum weight of 80,000 lb. is suggested principally in order to reduce the number of restricted movements due to weight limits on scales, bridges, etc.

2. Scale test cars of proper design should have the following characteristics:

(a) All-metal construction.

(b) Length of wheel-base not to exceed 7 feet.

(c) Load distributed uniformly on wheels.

(d) No unnecessary ledges or projections likely to catch and hold dirt.

(e) No unnecessary parts.

(f) Strength and durability so that frequent repairs will not be necessary.

(g) Surface area reduced as much as possible, to limit wind pressure.

(h) Accessibility of all parts for inspection.

(i) Roller or ball bearings reduce rolling resistance, thereby providing for ease of movement by scale inspector. They do not require sponging and repacking of journal boxes, which materially changes weight of test car between periods of verification and for these reasons are preferable to journal bearings.

3. Test cars may be of the self-contained type, having a body of solid castings with space provided for a small amount of test weights, or of the compartment type, having a body of structural and plate steel with space for test weights equal in weight to that of the car. The car of the self-contained type is preferable.

4. When supercargo (consisting of tools, overclothes, etc.) is carried in test car, it should be removed when the weight of car is being verified on master scale, also when testing track scales. To facilitate handling of supercargo, it should be contained in a removable steel box, properly stenciled to show that it is not a part of the test load. There should be stenciled on the outside of each of the doors of the compartment in which this box is carried the following note:

"This box contains supercargo, such as tools, etc., used

for adjusting track scales, and must be taken out of car when car is weighed on master scale and when testing track scales."

5. Scale test cars should be moved on the rear end of trains, just ahead of the caboose.

6. Scale test cars should not be kept on trains in yards while the latter are being switched, but should be so placed that rough handling will be avoided. In no case should these cars be subjected to impact at a speed greater than two miles per hour.

7. All excess weight, resulting from the accumulations of snow and ice, should be removed from scale test cars before they are placed on scales for the purpose of testing. To remove this, an engine with steam-hose connections may be used to thaw it, or hydro-carbon, where available, may be employed if used with care.

8. Oiling and repacking of test cars should be looked after while test car is at master scale for verification.

9. Scale test cars should be verified on master scale at least every three months, or after each general test trip.

10. In order to maintain the verified weight of the scale test cars at all times, no repairs of any nature should be made while in transit or boxes sponged without notifying the scale inspector in charge of the car, in order that he may be present to determine and arrange to take care of any differences between the weight of parts applied and those removed. To insure compliance with this rule, there should be located in a conspicuous place, so that it can be read from either side of the car, a badge-plate, with some such notice as: "Do not oil or repack boxes or make repairs to this car unless directed by scale inspector."

11. In case a scale test car is damaged so as to require extensive or heavy repairs, it should be returned to the master scale for verification after the repairs have been completed.

Discussion

(The report was presented by B. H. Mann, chairman, who moved the action recommended in the conclusions shown above. The motion was carried and the committee was dismissed with the thanks of the association.)

Report on Economics of Railway Operation

In Appendix A the committee submitted a formula for the assignment of certain operating expenses to determine the terminal costs of handling freight traffic. While this is now being modified to meet recent changes in accounting instructions, it is considered of value as a matter of information. This formula is a modification of the "Arkansas Formula." It is a detailed method for ascertaining terminal costs and is applicable to large and small stations. It was prepared in 1918 for collecting costs for use in connection with various rate cases in C.F.A. territory by E. F. Saur, special agent, Pennsylvania Lines, and H. E. Coverston, Special Agent, C. C. C. & St. L.

This formula covers about 85 per cent of the total charges to operating expenses and can be used with only a fraction of the cost of applying the complete Arkansas Formula. The costs omitted are not easily assignable and are in general those least liable to be affected by changes in methods. It is carefully worked out. It is now being modified to meet recent changes in accounting instructions. Further study will probably develop the need of some refinements, the ratio of 3 to 1 for sidetrack maintenance being one such.

The formula makes no attempt to consider anything but actual expense charges. The value of the facilities used does not enter into the results. While the formula was prepared for the purpose of rate cases, it is also adapted for use as a basis for studies of operation and for comparisons of costs under varying conditions. There are many items of expense not affected by changes in conditions and for any particular study the unaffected items can be omitted. A similar formula can be prepared for road costs.

Allocation of Maintenance of Way Expenses to Passenger and Freight Service

The Interstate Commerce Commission, by an order dated December 1, 1919, has prescribed, effective January 1, 1920, rules governing the separation of operating expenses between freight service and passenger service applicable to every carrier by steam railway whose operating revenues exceed $1,000,000 per annum. These rules cover not only the maintenance of way and structures group of accounts but all operating expense accounts.

It is the view of the committee that the separation of maintenance of way and structure expenses between freight and passenger service, while of the utmost importance as a basis for determining the reasonableness of a given rate or body of rates, is of but slight value otherwise. Inasmuch as the supreme rate-making body has prescribed a complete and definite method to which the carriers must strictly adhere in their cost accounting, the committee is of the opinion that the allocation of maintenance of way and structures expenses to freight and passenger services has, as a practical matter, been taken out of the field of controversy and nothing is to be gained for the present by study and discussion of this cost accounting problem which has led to such wide variations of opinion in past rate litigation. If at some future time the experience of the carriers develops obvious defects in the basis prescribed by the Interstate Commerce Commission and it appears that substantial injustice is done thereby, the subject of a proper method of separating these expenses might again become a practical and important question, but the committee think that, at least until the railroads have given a fair trial to the methods prescribed by the Commission, the subject of a freight-passenger separation of operating expenses is of theoretical value only.

Committee: F. W. Green (St. L. S. W.), chairman; V. K. Hendricks, vice-chairman; G. D. Brooke (B. & O.), Ralph Budd (G. N.), Maurice Coburn (P. L. W.), L. C. Fritch (C. R. I. & P.), C. M. Himmelberger (C. R. R. of N. J.), M. V. Hynes (C. I. & W.), Paul M. LaBach, Frank Lee (C. P. R.), Jos. Mullen, H. A. Osgood (Wabash), R. J. Parker (A. T. & S. F.), J. H. Prior (Cons. Engr.), W. G. Raymond (Univ. of Iowa), L. S. Rose (C. C. C. & St. L.), Mott Sawyer (C. M. & St. P.), Edward C. Schmidt, J. E. Teal (B. & O.), C. C. Williams (Univ. of Kan.).

Discussion

(In the absence of the chairman, G. C. Williams presented the report.)

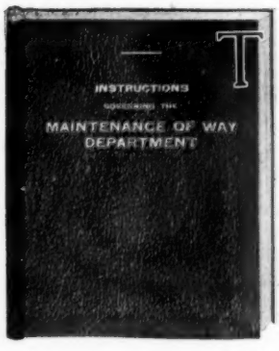
C. C. Williams (Univ. of Kan.): I would like to call attention to Appendix A, which gives the method of analyzing costs for the solution of special problems, relating particularly to the division of operating expenses between line and terminal. This is a formula that has been used on the Big Four and certain other lines with success and satisfaction. Several of the details of the

formula will need to be modified from time to time, but it is submitted as a workable method of undertaking this problem.

C. A. Morse (C. R. I. & P.): I want to say that I read part of the report of the committee, and was specially interested in the latter part, their suggestions as to matters of interest that were being effected under the new rules in regard to the payment of train crews. I think it is a subject that is of very great importance to the railroads, and that it ought to be discussed. One thing that struck me as very interesting in looking it over was their reference to the fact that possibly with a proper study of the conditions, instead of grade reductions and line improvements that we have looked at with a good deal of interest in past years, more running tracks was the thing that was going to be necessary; that we have got to get our trains over the road in shorter time and do away with time and a half for overtime on freight trains. I think it is a big subject for thought and careful consideration on the part of this committee and the association, in regard to that very thing. We are all up against the question of new working conditions, and if running tracks are what are necessary in order to reduce operating expenses, instead of some of the other things that we have thought for years were the proper things to do, we ought to know it.

(The committee was dismissed with the thanks of the association.)

Report on Rules and Organization



THE COMMITTEE in Appendix A presented rules for the inspection of bridges and culverts and recommended its approval and publication in the Manual.

Committee: W. H. Finley (C. & N. W.), chairman; F. D. Anthony (D. & H.), vice-chairman; O. F. Barnes (Erie), E. H. Barnhart (B. & O.), W. C. Barrett (L. V.), H. L. Browne (C. B. & Q.), J. B. Carothers (B. & O.), S. E. Coombs (N. Y. C.), H. H. Edgerton (C. G. W.), B. Herman (Sou.), *A. J. Himes, F. D. Lakin (Erie), Jos. Mullen, E. T. Reisler, W. H. Rupp, P. T. Simons, R. E. Warden (M. P.).

Appendix A—Rules for Inspection of Bridges, Trestles and Culverts

Wooden Structures

The inspection of foundations and masonry by the division bridge inspector shall include the following:

Examine each arch, abutment, pier and their foundations, bridge seats and pedestals. Report any new cracks, settlements or increase of old defects, scouring around foundations or change in channel of stream. Special attention should be given to all work of this character, where any defects have been previously found and no action taken to remedy same. The attention of track foremen shall be called to the importance of cleaning the bridge seats, the superstructure, channels, weeds and vines from the masonry and the removal of grass and weeds in and around the bents as well as all wooden trestles and structures. The division bridge inspector should note such conditions on his report, and show the action taken in order to correct same. The division bridge inspector must see that all bridge seats and cap stones of pedestals are properly set, reporting any movement or cracking of same.

The division bridge inspector should report and examine in detail the track approaches to through bridges and trestles to see that same are maintained in good line and surface, fully ballasted and that the rails on open deck structures are spiked in accordance with standard instructions, and that there is a full bearing on each tie. The division bridge inspector should inspect all joint fastenings and connections to see that they are in good condition, giving particular attention to see that standards are fully complied with where decks of ties are renewed out of face. He shall also see that the inside guard rail is placed on the structure in accordance with standards. He shall examine all ties and timber guard rails on open deck bridges for soundness. He shall see that the ties hold the spikes firmly; that all bolts are tight; that no guard rail or bolt ends in guard rail project above the level of the top of running rail a greater distance than 1 inch.

The division bridge inspector shall make inspection of all timber in wooden structures, trestles and timber trusses, boring in same where necessary in order to determine interior decay. He shall examine chords closely at splices and all stringers at bearing points. He shall examine diagonal and vertical posts and laterals to see that they are truly in place, straight and sound and shall pay particular attention to any crushing at the ends. He shall examine all angle blocks, main and laterals, reporting if broken or cracked. He shall examine gib plates, noting particularly their bearing on the timber. He shall examine all rods to see that they are in proper adjustment and pay particular attention to every other part of the structure in detail not mentioned above. When adjustment of any member is necessary it must be done under the personal supervision of the.....or his representative. The division bridge inspector must report any odd size timbers, or span lengths of timber stringers in wooden structures or trestles which are not according to the standards, and shall report if any new work is not done in accordance with standards. The division bridge inspector shall see that all timber bents are plumb and have transverse bracing, and in case of high trestles, particular attention must be paid to the longitudinal bracing and any deviation from the standard plan must be immediately reported.

Steel Structures

The division bridge inspector shall inspect all iron and steel work in metal structures and shall see that the steel is cleaned free from rust and that no water pockets are formed at the panel points. He shall examine every part to see that it is in true line, uninjured and in proper adjustment. He shall examine the line of girders to see it is correct and that the girders are setting plumb on the pedestals, masonry or bridge seat. He shall examine the bed plates, rollers and their frames to see that they are true and level and in proper working order. He shall see that all trusses and girders have a uniform bearing on the rollers, bed plates or pedestals. He shall examine by sounding with a hammer all rivets to see that none are loose, reporting all loose rivets, giving their location by bridge number and the number loose in each. It shall not be required that all rivets be tested more than ..... each year, except in certain members where the rivets are especially liable to become loose. Examinations of such members should be made at least once every ..... months. The division bridge inspector should give particular attention to any member which shows evidence of wear by becoming loose, rattling or rusting. To this end he shall give particular attention to all web members of trusses, lateral bracing, floor beams and stringer connections, yokes or hangers and connections at pins. He shall observe the action of the structure under trains operating over same at scheduled speed. He shall note any tension member which becomes slack, or any buckling which may occur in compression members. He shall note any perceptible yielding of the floor beams or stringers, or any perceptible side motion of the structure or any excessive deflection under traffic.

The division bridge inspector shall pay particular attention to the details of metal structures as outlined above when the alinement is a curve. He shall look for loose rivets in all angles, especially in floor beams and stringer connections. He shall examine the steel for cracks at the root of all angles and web plates of girders, floor beams and stringers. He shall examine top and bottom cover plates and angles, flange angles of deck girders and floor system of through girders and trusses for deterioration from rust and other causes. He shall carefully examine all bearings where girders rest on

*Died November 3, 1919.

pile, or frame bents, posts or towers, and shall see that the girders have a full and true bearing and are firmly anchored.

Masonry and Composite Structures

The division bridge inspector shall examine all masonry, concrete and composite structures for development of cracks or defects in abutments or piers. He shall examine deck for development of new cracks in masonry, pulling away of deck from piers or abutments. He shall examine underpart of ballast deck for cracking of concrete from reinforcement and shall report deterioration of reinforcement where exposed. He shall also report on failure of waterproofing of deck, causing a cracking of underconcrete protection of the steel structure.

Culverts and Pipes

The division bridge inspector shall examine all culvert and pipe openings to see that same are in good condition; that the sections of pipe are not pulling apart, and that they are kept cleaned at all times, so as to maintain full waterway and there is no undercutting at ends. He shall carefully examine walls and roof of masonry culverts, to see that no cracks are developing and roof is being properly maintained.

Records

The .... (Title) .... shall keep in his office an up to date cabinet and card filing system upon which shall be entered the reports of the division bridge inspectors. This card index system should have guide cards for each individual bridge, using separate color for bridges and structures requiring special attention. A particular designation may be used for any weak structures which must be carefully watched. Guide cards should contain the following information: Bridge number, mile post, first station east of bridge, total length of bridge, number of spans, length of each span, maximum height, base of rail to water or road, kind or style of structure, date built, clearance of bridge over railroad or highway.

Discussion

(In the absence of the chairman, W. C. Barrett presented the report and moved that rules for inspection of bridges, trestles and culverts given in Appendix A be approved by the association for printing in the Manual. The motion was carried and the committee was dismissed with the thanks of the association.)

Report on Economics of Railway Labor

In Appendix A the committee submits a number of suggestions on methods for training and educating engineering and maintenance department employees as information, and its recommendations are given under the heading of Conclusions.

Plans for buildings and boarding cars for maintenance of way employees were submitted in 1918, and in 1919 were referred to the Committee on Buildings, which was instructed to criticise the plans and furnish details. The Committee on Buildings has approved the plans as submitted and reports them in sufficient detail without revision. This committee therefore offered the plans submitted in 1919 for approval and publication in the Manual.

Conclusions

The committee recommended that the assignment to report on plans and methods for organizing to obtain labor for railways be reassigned.

The committee asked to be relieved from further consideration of methods of equating track sections and also of the manner of establishing proper relations between units of track expenditure and units per mile of line for different classes of track for the purpose of determining a normal maintenance expense.

The committee recommended that the information presented in Appendix A on methods for training and educating engineers and maintenance of way department employees be accepted as information, printed in the proceedings, and the subject reassigned.

Committee: E. R. Lewis (Railway Age), chairman; C. H. Stein (C. R. R. of N. J.), vice-chairman; W. J. Backes (N. Y. N. H. & H.), A. F. Blaess (I. C.), W. M. Camp (Ry. Review), W. R. Dawson (N. & A.), W. D. Faucette (S. A. L.), R. H. Ford (C. R. I. & P.), W. R. Hillary (P. R. R.), C. B. Hoyt (N. Y. C. & St. L.), W. A. James (A. C. L.), C. E. Johnston (K. C. S.), A. C. Mackenzie (C. P. R.), C. A. Paquette (C. C. C. & St. L.), J. W. Pfau (N. Y. C.), J. R. Sexton (Erie).

Appendix A

The sub-committee appointed to study and report upon methods for training and educating engineering and maintenance of way department employees feels that this subject naturally presents two separate divisions: (1) The training of the engineer, and (2) the training and educating of supervisors and foremen.

Training of the Engineer

Generally speaking, the newly-graduated engineer is a mathematician and the problem is to make him also an economist. This is usually a slow and exacting process. We feel it to be true that, on most railroads, the training and educating of engineers is unmethodical. The result has been that the development of the individual is almost wholly that which comes from his being thrown upon his own resources.

There should be at the command of the engineer such control of materials and primary accounting that he may at all times check up, in a thoroughgoing manner, the work under his direction and be made responsible for the economical performance of it. In addition to having a system by which men in charge of work may readily ascertain costs when they are incurred, it is the opinion of the committee that, on the roads where the size of the engineering forces will warrant, there should be attached to the department a man well equipped with practical experience and technical training who would be fitted to conduct a program of development. Such a man would collect statistics, make an analysis of work accomplished and direct a campaign involving regular meetings composed of the members of the engineering force from the various divisions as well as from the general office. Papers would be prepared on subjects assigned to individuals and reports made on matters referred to committees whose membership should include beginners as well as those advanced to higher positions in the service. At such meetings constructive criticism should be advanced as to work subject to comment, either as to methods of prosecution or economy.

In the training of young engineers the essential feature is to teach them to properly gage productive effort. Probably one of the best methods is to establish a system by which a certain percentage of the positions of supervisor may be filled from the engineer corps. This system affords the engineer an intimate detailed knowledge of the methods of applying material; it enables him to fairly gage the reasonable product of labor, and brings him in direct contact with the foremen and the men, a feature which, when he has been promoted to division engineer or some higher position, is of immense

advantage to him. One of the requirements for appointment to the position of division engineer, or engineer maintenance of way, should be at least two years' experience as supervisor.

Another step in the education of the young engineer should be a requirement that he have not less than one year's service in the office of the chief engineer. This will impress upon him the theories which have been acquired at school and give opportunity for applying them in practice. It is a fact to be deplored that there is a great lack of designing ability among maintenance engineers, that is to say, from the division engineer down. Too much attention is paid to the tamping of ties and the construction of sidetracks to the exclusion of the fundamentals of engineering design. Service in the general office will in a measure cure this condition, which is a shortcoming not because of faulty education but because of lack of opportunity to apply in practice the things learned at school.

To summarize as to engineering forces, we suggest:

(1) Employ in the engineering corps men of sufficient technical training to be useful in solving the ordinary engineering problems.

(2) Carry on an educational campaign through regular and periodical meetings, the members to exchange views through the media of papers, reports and discussion.

(3) Fill a certain percentage of the positions of supervisor of track, supervisor of bridges and buildings, supervisor of signals and inspector from the engineering corps on an equal footing with other applicants.

(4) Systematic rotation of service for the members of the engineering corps, to include surveying and field work, inspection, supervision of maintenance and construction and work in drafting and designing.

Training and Education of Supervisors and Foremen

In the training of supervisors and foremen not having the advantage of a technical education the problem is different from that of the engineer. As most railroad organizations are now constituted, efficiency in the work of the department depends largely upon the capability of this group.

Their schooling, generally, has been their practical experience, and this may have been long and profitable, or comparatively short and unprofitable. It is deplorable that in recent years on most lines of railroad the percentage of comparatively inexperienced men among supervisors and foremen, particularly the latter, has greatly increased. The resultant inefficiency is so serious that it may well cause earnest thought as to how to educate and develop these men.

It is noticeable that where there is an excellent supervisor, there will invariably be found foremen of far above average capabilities, and the reverse is true where the supervisor is not capable. This is merely a reflection of wise and efficient direction in the prosecution of work and emphasizes the fact that most men, particularly younger men, want to learn and especially will they do so if the instruction is imparted in a manner to incite interest and appeal to their pride.

The education of the supervisor and foreman must come from the instruction and guidance of their superiors. Standard methods of achievement should be developed and their purport fully understood by supervisors and foremen. After that has been done, full adherence thereto should be insisted upon through rigid and constant supervision.

Probably one of the best ways to induce development in this class of supervisors and foremen is to assemble a number of them at occasional meetings for the discussion of their common problems. This practice tends greatly to broaden the view and enlarge the interest of these men as well as to establish an *esprit de corps*, without which there can be no enthusiasm nor sustained interest in excelling in their particular line of activity.

In contemplation of the future, some plan for inducing men to qualify for the position of foreman, especially in track work, assumes great importance, judging from the immediate past. It seems to the committee that an arrangement for apprentice foremen should be established, either by creating such a position in each section gang, and paying rates sufficiently above the laborer's rate to make the position attractive, or by the forming of apprentice foremen gangs on each engineer's division. In either case the men to be carried as apprentice foremen should be recommended by the foreman and supervisor. It should not be necessary to have apprentice foremen on all sections of light traffic lines, but there should be enough apprentice foremen on the heavier lines and terminal sections to insure the training of candidates to fill vacancies in the ordinary course of events. These apprentice foremen should be closely observed by the supervisor to determine their fitness for the position of foreman. They should be under the direction of the most competent foreman on the supervisor's district.

One of the most important things in the education of foremen is to bring about their realization of the importance of correct records of working time and material used, and the knowledge of the right way to keep and distribute time. They cannot be made to realize too keenly that time and money are measures of efficiency as well as workmanship.

Some railroads have adopted a policy of furnishing track foremen with subscriptions to technical periodicals that are devoted particularly to track matters. Indicative of the interest taken by the men, and of their desire to enlarge their knowledge, is the fact that these track foremen frequently write letters to these magazines giving their experiences and raising questions as to the problems with which they have to cope. On one line of railroad where this policy has been carried out, it is the practice of the division engineer, when an article appears which is of especial interest to this class of employees, as the occasion presents, to discuss it with the supervisors and foremen, and invariably it is found that the men have read the article, which merely demonstrates "that men want to learn." The most effective results, however, are to be obtained through the medium of personal contact. The supervisor is, of course, in frequent conference with the engineer, and the supervisor should be required to call on each section foreman, spending at least an hour with him not less than once every two weeks.

Summarizing, therefore, we have to suggest with respect to supervisors and foremen:

(1) That they, from convenient stretches of territory, be occasionally brought into informal meetings with department officials for the purpose of discussing the various phases of work and for mutual acquaintance and full understanding.

(2) That in such meetings they be given full explanation of the objects and uses of their reports, so that a keener appreciation of accuracy on their part will be realized.

(3) That they be furnished with full information with respect to the maintenance of way standards and that these and the reasons therefor be explained to them.

(4) That a system of apprentice schooling be estab-

lished from which men can be drawn for the position of foreman.

Discussion

E. R. Lewis (chairman): In Appendix A is given a report on training and educating engineering and maintenance department employes, and the committee asks that the matter contained be accepted as information.

Plans for buildings and boarding cars for maintenance of way department employes were printed in the proceedings last year. They have not been reprinted, but, as I understand it, have been approved by the Committee on Buildings, to which they were referred.

On behalf of the committee, I move that they be adopted and printed in the Manual.

The President: The Chair wishes to state that when this matter was brought up in connection with the report of the Committee on Buildings they asked to withdraw the recommendation they had made, which was to the effect that the matter in question be made a subject of reference in the Manual, that is, to the plans already published in the Proceedings. Therefore, it is not in order for the Committee on Economics of Railway Labor to move the approval and publication of this matter, inasmuch as the committee that had the handling of it has withdrawn its request for approval. The Chair suggests that this committee co-operate during the coming year with the other committee and get their approval and consent to have these plans published and inserted in the Manual next year.

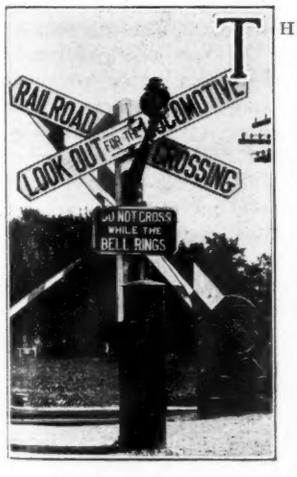
Prof. S. N. Williams: I wish to express my high appreciation of the value of the report on "Methods for Training and Educating Engineering and Maintenance Department Employes." I having been concerned for 40 years in the training of young engineers, and this portion of the report appeals to me strongly. As a member of the association, I wish to express this appreciation in this public way.

Fred Lavor (American Int. Corp.): I do not know whether the committee had called to its attention a conference held in Washington last June on the training of engineers for foreign service. There is a good deal in the report of that committee, which can be obtained in Washington, which is of interest to engineers, and particularly railroad engineers.

The Chairman: That report has not been brought to the attention of the committee, and we are grateful to have it called to our attention at this time.

(The committee was dismissed with the thanks of the association.)

Report on Signs, Fences and Crossings



THE SUBJECT of signs is being studied by a sub-committee with a view to reducing the number of signs to a minimum and promoting uniformity of practice in their use. The committee recommended that the following paragraph be approved and published in the Manual at the foot of page 316:

ROADWAY AND INFORMATION SIGNS

"Signs for Dump Ashes, Blind Siding, Water Station, Fuel Station, Beginning of Double Track and End of Double Track to be similar to sketch shown on page 318, 1915 Manual, for Trespass Signs."

The committee recommended that the sketch of Approach Warning Sign be approved and published in the Manual.

Committee: Arthur Crumpton (G. T.), chairman; Maro Johnson (I. C.), vice-chairman; F. D. Batchellor (B. & O.), H. E. Billman (M. P.), C. G. Bryan (I. C.), G. F. Black (Me. C.), B. J. Dalton (M. K. & T.), F. T. Darrow (C. B. & Q.), G. N. Edmondson (N. Y. C.), Paul Hamilton (C. C. C. & St. L.), L. C. Lawton (A. T. & S. F.), S. L. McClanahan, L. A. Mitchell (Un. Tr.), T. E. Rust, W. F. Strouse, A. Swartz (Tol. & West), W. D. Warren (N. Y. N. H. & H.), K. G. Williams (Mem. Un.), B. A. Wood (M. & O.).

Appendix B—Fences and Stock Guards

Abstracts of the laws of all of the states and Canada relating to the providing of right-of-way fences and the installation of stock guards were presented in 1917 and the same information was given in tabular form in 1918. Eight states specified that fences should be 4 ft. high, ten others and Canada specified 4 ft. 6 in., while two others called for 4 ft. 6 in. and 5 ft. Twenty-nine states do not specify the height of fence required.

The Manual contains specifications for standard right-of-way fences of four classes. A recent inquiry as to the extent of the use of these standards elicited replies from 32 railroads showing their use by 11 roads, while they are not used by 21 of the roads replying. Various reasons were given; 6 use their "own standard," 2 use "better standard," 2 have "no standard," 2 "have to conform to state requirements," 2 say "not suitable," while 7 give no reason.

Appendix C—Over and Under-Grade Crossings

In recent years the subject of the elimination of railroad grade crossings in many of our larger cities has been given a great deal of attention by American engineers. This has been due to the rapid increase in both steam railway and street traffic, particularly automobile and motor truck traffic.

At the present time the improvement of street railway traffic is perhaps uppermost in the public mind. The need for more cars, more rapid movement of cars, relief from congestion in the downtown section, additional lines and the possibility of establishing some form of rapid transit are all matters of public discussion.

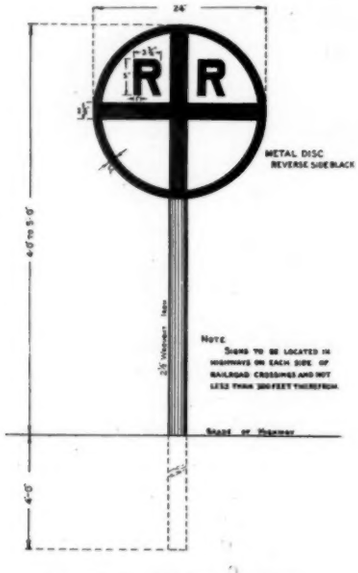
The development of the automobile in the past few years, which has resulted in the tremendous increase in the use of motor-driven vehicles, has introduced a new element in street traffic. Streets which a few years ago had only a few team movements per day are now traveled by hundreds of thousands of automobiles and teams per day. This increase in number of street movements tends to emphasize the importance of abolishing grade crossings, especially when it is considered that on many streets there has been a corresponding increase in pedestrian traffic. Certain streets are, and always will be, the principal arteries of travel to the outskirts of the city. Connecting these are other streets which are thoroughfares to certain factory districts or important connecting links in the street system. All these must be open to uninterrupted street traffic to properly meet the transportation problem.

Referring to the relations between the general public,

the manufacturers and the railroads, the following observations are made:

"The public demands an open and safe thoroughfare, with sufficient headroom to permit any usual street or street railway vehicle to pass freely. It must consider the future, and not limit, by present-day construction, the reasonable future use of the street. The public may very properly protest against going up or down a heavy grade or against narrowing any roadway or against closing any road which may in a few years be essential to guard against congestion. The public has a right to demand not only a safe but a clean, reasonably noiseless and sightly structure. In view of the fact that the public uses the crossings on important streets tens or hundreds of times to the railroad's once, the public interest may be considered paramount. However, we must not lose sight of the further fact that the railroad is a public transportation utility, and that the only reason for the existence of most of the railroad tracks is for the convenience of that same public which uses the streets.

"The railroad demands good grades, safe headroom, the opportunity to run its through trains at high speeds; the right to maintain, for the benefit of its patrons, all such facilities at stations and team tracks; the right to have ample yard facilities for switching, sorting and storing of cars and to have the yards so located that they will meet the requirements of the different parts of the city; and further, the



Approach Warning Sign

right to maintain all necessary track connections to industries adjacent to or within reasonable distance of its lines.

"The owners of industries must have such connections as will permit the receiving and shipping of freight; the use of adjacent streets and freedom from interruption to the movements of teams and employees to and from the industries. The fact that hundreds of industries are now in existence on tracks at the surface level; that they have built and adjusted their business to those tracks, greatly complicates matters, as a change in level of track or street or both is sure in most cases to require a readjustment or reconstruction to fit new conditions.

"In some cases the existing arrangement at manufacturing plants can be used without material change; in other cases a readjustment can be had by elevating the industrial spur and loading platform, or by an interior rearrangement; in still other cases, more especially very small industries, the cost of the construction to meet any condition that would be considered necessary would be such, perhaps, as to compel a removal of the business to some other location."

In the past, three general methods of grade separation have been employed, as follows:

(1) The railroad grades are left undisturbed and the streets are either depressed and taken under the tracks or elevated full height and taken over the tracks.

(2) The street grades are left undisturbed and the railroads depressed or elevated to the extent required.

(3) The grades of both railroads and streets are changed as to best suit the requirements of a particular case or district.

Respecting the first method it may be said that early work in grade separation has in general consisted in the elimination of a few isolated grade crossings in the country or small cities where the advantages to be gained from a safe crossing overcame the disadvantages due to bad grades or unsightly structures. In most of these cases the railroads have borne all, or a larger part, of the cost, and have only been benefited to the extent that a source of danger was removed. Under such conditions the railroads have argued that if a community wanted a grade crossing eliminated it would have to stand for some inconvenience. This procedure has frequently resulted in creating such conditions that no subsequent change in track grades could be made without destroying work already done.

The advantages and disadvantages of this method may be summarized as follows: The advantages to the railroads are (a) undisturbed main tracks, (b) undisturbed grades, (c) undisturbed yards and industrial connections. The disadvantages to the cities are (a) heavy property damages due to street grade changes, (b) interference with sewers, drains, water mains, and other sub-surface construction, (c) impediment to street traffic due to the introduction of heavy grades, (d) unsightly appearance of streets, and (e) inconvenience to adjacent industries.

The advantages and disadvantages of the second method may be summed up as follows: The advantages to the city are: (a) streets are left on original grade, (b) that it practically or wholly eliminates property damages, (c) causes no disturbance of sewers, drains, water mains, or other sub-surface construction. The disadvantages to the railroads are: (a) introduction of additional grades and rise and fall of 18 to 25 feet at one or both ends of the district, (b) more or less serious interference with industrial tracks, sometimes necessitating removal of small industries to other locations, (c) necessitates reconstruction of stations and team track yards, (d) may necessitate removal of yards.

Whether the cost of changing track grade will exceed the cost of changing street grades will depend largely upon the number of streets affected and the contour of the adjacent ground. Obviously, elevating the tracks for two or three streets would be considered bad practice, and there are cases where the cost of elevating the railroad would exceed the cost of raising or lowering the streets, but in the average level city where the change of grade of a mile of track would involve 10 to 12 streets there is little difference in cost. The cost of permanent bridges and carrying street traffic during construction are substantially equal in either case, and the cost of carrying street traffic where it must be maintained is less in the case of railroad elevation than in the case of street depression.

Respecting the third method, the committee feels safe in saying that few grade separation projects have been carried out under either of the above plans, but generally under this method, viz., elevating the railroad tracks 8 to 10 ft. and depressing the streets 10 to 14 ft. In adopting this method it has been recognized that it is to the best interests of all three parties to make such adjustments as are really for the greatest good, hence no hard and fast rule can be adopted which is equally applicable under all conditions. Perhaps the most important consideration leading to a decision respecting depressing streets is the matter of drainage.

The matter of clearance is one which should be given more careful consideration. To provide for the increase

in size of rolling stock some very expensive work has been necessary in the way of lowering grades, etc., and, where this could not be done, it was often necessary to refuse extra large shipments.

Discussion

Arthur Crumpton (chairman) presented the report, and after reading the matter contained under "Roadway Information Signs," he moved that it be approved for inclusion in the Manual.

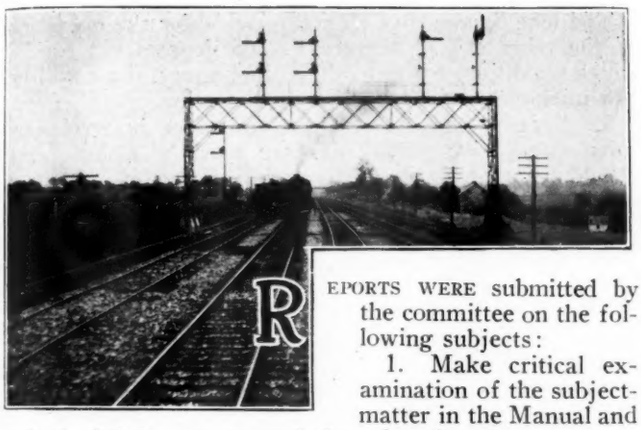
(Motion seconded and carried.)

The committee then moved that the approach warning sign be approved for inclusion in the Manual.

(Motion seconded and carried.)

(The committee was excused with the thanks of the association.)

Report of Committee X—Signals and Interlocking



REPORTS WERE submitted by the committee on the following subjects:

1. Make critical examination of the subject-matter in the Manual and submit definite recommendations for changes.

The corrections which the committee recommended for the Manual were of a minor nature, and were not of such character as to warrant printing in the report.

2. Report on the problem of signaling railroads with reference to the effect of signaling and proper location of passing sidings on the capacity of the line.

The committee felt that it had completed the work on this subject so far as it relates to the proper location of passing tracks and reported fully on same and that the portion of the subject relating to the location of signals is covered by subject (7) and will be handled under that item. Recommendations relative to this subject are given under the heading of Conclusions.

3. Report on the specifications adopted by the Signal division of the Engineering Section of the American Railroad Association which warrant endorsement, conferring with Committees Nos. 5, 6 and 15 and other appropriate committees on appliances affecting track or structures.

In Appendix A the committee submitted list of matters acted upon by the Signal division of the Engineering Section of the American Railroad Association at its convention in 1919 and adopted by letter-ballot. Recommendations on this subject are given under the heading of Conclusions.

8. Report on automatic train control.

In Appendix B the committee presented a comparative statement of the definitions and requisites for automatic train control devices that have been adopted by various committees and associations. Recommendations are made under the heading of Conclusions.

14. Investigate and report upon the effect of the use of ties treated with any solution which affects the length of track sections.

In Appendix C the committee submitted a partial report. Recommendations on this subject are given under the heading of Conclusions.

Conclusions

The committee recommended that the following action be taken on the reports submitted:

2. That the matter relative to this subject previously submitted by the committee and accepted by the Association as information be considered as complete reports relative to the effect of the proper location of passing tracks on the capacity of the line, that the remainder of the subject is involved with subject No. 7, should be combined with it and subject No. 2 withdrawn.

3. That the list of Signal division, Engineering Section of the American Railroad Association, specifications and standards submitted as Appendix A by the committee be published in the Manual as supplementary to the list of Railway Signal Association specifications and standards heretofore submitted for the information of the members.

8. That the report submitted in Appendix B be accepted as information.

14. That the report submitted in Appendix C be accepted as information.

Appendix C—Report on Use of Zinc-Treated Ties in Track Circuits

1. As the electrical condictivity of zinc-treated ties decreases with age during the first year, better results may be had by allowing the ties to season for a period of from two to six months before using in a circuited track, thus avoiding the use of the tie while its conductivity is greatest.

2. For good results, the number of zinc-treated ties installed per year in any track circuit should not be greater than 15 per cent of the total number of ties in that circuit.

3. (a) It is recommended that maximum rail resistance not to exceed 0.1 ohm per 1,000 ft. of track be maintained. Ordinarily it will be lower. This resistance can and should be reduced to a minimum by using bonding wires of high conductivity or increasing the number of bonding wires per joint.

(b) Rail and bonding resistance may be determined by the following formulas in which

E = Volts at rail — battery end.
e = Volts at rail — relay end.
I = Amperes flow from battery.
i = Amperes flow through relay.
R = Rail and bonding resistance total in ohms.
r = Rail and bonding resistance per 1,000 ft. of track in ohms.
L = Length of track circuit in feet.

$$R = \frac{2\,(E - e)}{(I + i)}$$

$$r = \frac{2000\,(E - e)}{L\,(I + i)}$$

4. (a) The length of track circuit should be determined by the ballast resistance or the resistance from rail to rail through ties, ballast, and track insulation.

(b) The following table expresses in ohms, per 1,000 ft. of track, ballast resistance on various kinds of ties:

Date 1917	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Temperature	Humidity
April 12	4.27	5.36	48.02	44.55	24.87	13.37	40 deg. F.	40%
May 17	2.28	3.22	34.52	24.68	21.19	12.42	82 deg. F.	73%
June 8	1.91	2.76	15.66	15.72	9.50	5.82	58 deg. F.	50%
Aug. 6	3.48	6.42	32.82	26.99	12.65	16.05	78 deg. F.	46%
Sept. 14	2.56	3.15	14.64	14.27	9.67	6.55	77 deg. F.	56%
Oct. 25	4.85	6.06	28.92	28.92	15.96	7.77	41 deg. F.	75%
Average	3.23	4.49	29.09	25.85	15.64	10.33		

Key: Section 1—Zinc-treated red oak.
Section 2—Zinc-treated red oak soaked and scrubbed.
Section 3—Red oak treated with 25 per cent creosote, 75 per cent gas oil.
Section 4—Red oak treated with 10 per cent creosote, 90 per cent gas oil.
Section 5—White oak untreated.
Section 6—Various species—old ties in place for several years.

(c) Ballast resistance may be determined by the following formulas, in which

E = Volts at rail—battery end.
e = Volts at rail—relay end.
I = Amperes flow from battery.
i = Amperes flow through relay.
Y = Ballast resistance total in ohms.
y = Ballast resistance per 1,000 ft. of track.

$$Y = \frac{(E + e)}{2(I - i)}$$

$$y = \frac{L(E + e)}{2000(I - i)}$$

(d) Unless the ammeter with which the current readings are taken is of an extremely low resistance, such readings should be taken only for the purpose of determining the resistance of the unit and relay. The current flow should then be calculated from these resistances and the voltage drop across them, otherwise the error due to the resistance of the instrument will affect the results.

(e) When the rail resistance is equal to .1 ohm per 1,000 ft. of track, a 2-ohm relay used, and the ballast resistance per 1,000 ft. of track as determined by the above formulæ is as shown below, the track circuits should not exceed the lengths shown opposite the following resistances:

1 ohm—2200 ft.
2 ohm—3400 ft.
3 ohm—4400 ft.
4 ohm—5200 ft.

The lengths as above shown provide for the operation of the relay at 150 degrees F. (65 degrees C.), under which condition, with .6 volt at the battery, there will be 115 milamperes flowing through the relay.

5. Because of a low ballast resistance in track circuits where zinc-treated ties are used, a 2-ohm relay should be used, as it will operate satisfactorily when a relay of higher resistance will not.

Committee: J. A. Peabody (C. & N. W.), chairman; W. J. Eck (Southern), vice-chairman; Azel Ames (Cons. Sig. Engr.), H. S. Balliet (N. Y. C.), A. M. Burt (N. P.), C. E. Denney (N. Y. C. & St. L.), F. L. Dodgson (G. R. S. Co.), C. A. Dunham (G. N.), W. H. Elliott (N. Y. C.), G. E. Ellis (I. C. C.), J. G. M. Leisenring (I. T. S.), H. K. Lowry (C. R. I. & P.), J. C. Mock (M. C.), F. P. Patenall (B. & O.), A. H. Rudd (P. R. R.), Mott Sawyer (C. M. & St. P.), A. G. Shaver (Cons. Engr.), Thos. S. Stevens (A. T. & S. F.), W. M. Vandersluis (I. C.), B. Wheelwright (G. T.), W. P. Wiltsee (N. & W.).

Discussion

J. A. Peabody (chairman) presented the committee's report, and after reading each subject under the heading "Conclusions" he moved the acceptance of the recommendations contained therein.

(Motions seconded and carried.)

(The committee was excused with the thanks of the association.)

Report of Special Committee on Standardization

NO SUBJECTS WERE ASSIGNED this committee for study and report, but the following instructions were approved by the Committee on Outline of Work of the Board of Direction:

1. Request appropriate committees to each select one or more articles for standardization, with instructions to harmonize the views of the railroads and manufacturers as much as practicable, and to prepare plans and specifications of as few sizes as will meet the needs of the railroads.

2. Secure the general use by the railroads of the standards and specifications, bringing about a realization of all possible economies of cost and time.

Subsequently the Board of Direction instructed the committee to confine its efforts to the general adoption by railroads of the standards and recommendations shown in the Manual, and to formulate suggestions for bringing about a realization of all possible economies of cost and time. In December, by request of the American Railroad Association, there was assigned to this committee the task of preparation of minimum specifications for as many items of standard railway materials as possible to serve as the basis for the purchase of such materials, and the committee is now actively engaged in this work.

The committee has no conclusions to present to the Association this year.

So far the work done by the committee has developed a large field of possible utility in which important results should be obtained. Many articles are used by railroads in a great diversity of sizes and types, a lesser number of which should fill every need of the roads, thus reducing the cost and the time for filling orders, due to increased possibility of carrying material in manufacturers' stocks. It is obvious that concentration of the demands of railroads on a lesser number of types and sizes will materially reduce the cost of producing the articles, which necessarily must work to the financial advantage of the roads. In spite of this self-evident fact, however, up to this time the adoption of the designs and specifications recommended by this Association has, with few exceptions, been far from general. A variety of reasons may be offered for this, such as minor details being unsatisfactory to manufacturers or to the purchasing or using officers of railroads, and quite largely to disinclination to change existing standards. Very largely, however, their lack of general adoption is due to lack of knowledge of their existence on the part of purchasing officers.

The committee feels that a concerted and determined effort should be made to cover, as far as may be desirable, the standardization of railroad requirements, and to this end it recommends that it be instructed to proceed with the development of this work along the lines indicated in the subsequent instructions by the Board of Direction, as indicated in the fore part of this report.

Committee: E. A. Frink (S. A. L.), chairman; J. R. W. Ambrose (Tol. Term.), vice-chairman; F. L. C. Bond (G. T.), W. A. Christian (I. C. C.), Arthur Crumpton (G. T.), A. F. Dorley (M. P.), J. M. R. Fairbairn (C. P. R.), W. H. Finley (C. & N. W.), W. H. Hoyt (D. M. & N.), Edwin B. Kattz (N. Y. C.), F. R. Layng (B. & L. E.), E. R. Lewis (Ry. Age), M. A. Long (B. & O.), B. H. Mann (M. P.), J. A. Peabody (C. & N. W.), G. J. Ray (D. L. & W.), H. L. Ripley (N. Y. N. H. & H.), O. E. Selby (C. C. C. & St. L.), C. M. Taylor (P. & R.), W. P. Wiltsee (N. & W.), J. J. Yates (C. R. R. of N. J.).

Discussion

The report was presented by E. A. Frink, chairman.

The Chairman: The committee has no recommendations this year as to conclusions. The utmost it has been able to do so far has been to start the work. With permission I would like to say a few words on the subject of standardization.

In the first place, standardization as applied to railroad materials is something that must be handled with the utmost care. There are a great many things used in railroad work that are not susceptible of standardization. For instance, you cannot standardize railroad paint. There are, however, a great many things that do admit of it—such as rails, tie plates, splice bars, bolts, etc.

The reason for that standardization is twofold: first, to reduce the cost; second, to increase the supply. Years ago the various mills in the country manufacturing structural steel used to make at least two grades of steel. Each mill used to have its own pattern of rolls. One mill rolled narrow flange beams narrower than any other mill. In those days engineers ordering material for railroad bridges used to order by weight., and they would order angles just the weight that would give the exact area required for the stresses. You can imagine what that meant to the rolling, constant change of rolls, parts of rollings left over, and put into stock with a grave question as to whether they could find anyone who wanted that size and weight.

That meant an increase in the cost of producing the materials, and the mills recognized it. They took measures to correct it, they standardized the types of material, and sizes of material, and you can now only get certain sizes of angles, and certain sizes of beams, and the result, I believe, has been a reduction in the cost. This also applies to other materials.

C. A. Morse (C. R. I. & P.): Mr. Frink's remarks suit my ideas exactly. There is one thought I have in connection with it that I am a little bit afraid of, and that is if all the railroads in the country had a standard, for instance, on tie plates, that it would be a question if we got the improvements in tie plates that we are getting now, with about forty different designs of tie plates being made by different manufacturers.

My hobby on this matter of standardization, the one thing I think we should attempt to do first, at any rate, is to try to standardize certain sections of rail. If we are successful in that one thing, we have made a big movement towards more extended standardization.

F. P. Patenall (B. & O.): I quite agree with the chairman in reference to standardization. Apparently it does stand forth as a misnomer, but standardization, as I look at the matter, means an incentive to make something better, and the fact that we standardize certain material does not mean that we are going to throw away everything we have in service, but it means that gradually, as that material wears out, we replace it with a standard article.

A. S. Baldwin (I. C.): One thing, I believe, that should come from this standardization is ability on the part of the association to bring about a more general use of its recommended practice in every respect. One weakness that we have had has been that the railroads are too slow to take up changes recommended by this association. Going over the standards, we are apt to think, this approximates what I have, or, I do not like this feature, or, something else is a little different from what we now have, and that leaves the standards that are adopted by the association to take their course and be adopted maybe by very few railroads. The new association that has been brought about between this organization and the American Railroad Association should enable us through this Standards committee to bring a great deal more force to bear upon the railroads in the adoption of the standards of the association. I think that is something that every member of this association should direct his efforts towards with his own particular company.

J. R. W. Ambrose (Toronto Term.): I think Mr. Baldwin has touched the key-note of the situation. First of all, I wish to remind you that this association has no standards. They do not believe in them up to the present time. Take the example of the Rail Committee. We railroaded through a specification today. Several members here who are interested in the subject said nothing. Apparently they approved that specification. They go right back to their executive officers and follow some other specification.

It seems to me that this committee might perhaps coordinate the work of all committees, but to do that, they must have more power than has been given to them at the present time. Taking the Rail Committee, for instance, I cannot conceive of any local conditions on this continent that would require any minute changes in the specifications for rail to suit those local conditions. Therefore, I see no reason why all of the railroads who are represented in this association should not approve some one specification, as well as sections. I think when a specification is passed up to this association, it should be endorsed by the executives of the railroads here represented, so that we might have some assurance that they are to be used.

Mr. Frink has pointed out the advantages. We all see the advantages of standardization. It comes down to economy. I care not what you call it, safety first, or good practice, or that it results in economy, and in these days economy is being pounded into us. It seems to me that this association has reached the stage where it can now have actual standards, and in some manner or other try to enforce those standards, if they are approved by the different roads in practice, and result in the economy that we desire.

Hadley Baldwin (C. C. C. & St. L.): I think that what this association has accomplished forms a sound basis for the greatest exultation. The adoption of our recommendations as standards might not add very many advantages. Probably we have had very few advantages, but the work of this association has been a great leveler, all across the whole field of railroad structures of every kind. Through the work of this Association we are very close to standards all over the country. If we adopt standards we believe that it would be more especially of economic benefit in getting a bigger supply, and perhaps a cheaper supply. As to getting very much better than we now have, in most cases I do not think we can look for very much improvement. I think the effect of this association has been that the quality of material used upon the railroads, is very nearly as good as any standard that we have adopted all across the field.

(Further remarks along these same lines followed, indicating considerable unanimity of opinion as to the prob-

lems involved without any tendency to designate specific methods at this time. A question arose as to the probable procedure in establishing a standard.)

The Chairman: It is the fixed purpose of the committee never to transmit to the Board of Direction any article or any specification until a sufficient mileage of the railroads of the country have acknowledged the correctness of the standard, and have said they would use it, and until a sufficient number of manufacturers of that particular article have said that they would make it, so that we may be sure of a supply. I cannot give you in percentage the mileage of railroads which we will require, because necessarily that will vary in different cases, but you can be sure that this committee will never recommend the adoption of any such standard until the mileage of railroads accepting it is sufficient.

(The committee was dismissed with the thanks of the association.)

President Stimson: The Chair appoints Past Presidents Morse and Baldwin as an escort of honor, to take President-elect Safford to the chair.

(Messrs. Morse and Baldwin escorted President-elect Safford to the platform.)

The President: Mr. Safford, I retire with the greatest confidence in your ability to fill the position, and I hand you herewith the symbol of authority of the office. That little hammer has driven home many good points and has never been used for knocking.

(At this point President Safford took the chair, and said): I want to thank you very cordially, Mr. Stimson, for your kind words, and to extend my congratulations to you for what I think has been the most successful year that the association has experienced. I know that I voice the sentiment of all when I say that for the membership at large, and it has been a great pleasure to me to serve under you.

G. A. Mountain (Can. Ry. Com.): I would like to say how much this pleases us—and I am speaking now, I think, for all of the Canadian members—to see Mr. Safford installed in the chair. He was with us in the north there for a great many years, and he endeared himself to us by his genial manner and his ability.

President Safford: Gentlemen, I appreciate more than I can express the honor which you have seen fit to confer upon me. Of course, it will be my desire to meet your expectations. The support which you have always given your presidents in the past, if continued, which, of course, it will, can result in greater success by your efforts alone even than has characterized past years. We are starting out today on another year, the twenty-second, I believe, with a great many new conditions and new problems to work out. Some of them grow out of the past two years of changed conditions in railroad service. Others grow out of the confusion and natural distortion of things that accompanied the war, and the special activity with which we are connected, the railroad business, is going to require a great deal more study than it ever required before. We have a number of problems of a technical nature, and a great deal to do in the direction of correcting those things which have disturbed the morale and contentment of labor. All these things call for new activities on the part of committees, and this in turn calls for greater study on the part of those standing committees of the Board of Direction which are in charge of the work and the personnel. As to the latter, we are increasing our membership, as you know, and that means new problems in this organization. I hope you feel that I am ready always to serve the association to the best of my ability, and I am quite sure that I will get that support from you. I thank you.

A. R. E. A. Registration

THE REGISTRATION AT THE closing session of the convention yesterday totaled 24 members and 18 guests, a total registration for the three days of 563 members and 196 guests, or a combined total of 759. This total of 563 members compares with a total attendance of members last year of 425.

Members

Ballard, E. E., Eng., M. K. & T., Dallas, Texas.
Bortin, H., Consulting Engineer, St. Louis, Mo.
Camp, W. M., Editor, Railway Review, Chicago, Ill.
Carothers, A. B., Assistant to General Manager, B. & O., Western Lines, Cincinnati, Ohio.
Clift, A. E., General Manager, I. C., Chicago.
Cook, R. A., Val. Eng., C. & A., Chicago.
Denney, C. E., Vice-Pres. & Gen. Man., N. Y. C. & St. L., Cleveland, Ohio.
Dodgson, F. L., Con. Eng., Gen. Ry. Sig. Co., Rochester, N. Y.
Farlow, G. B., Asst. Eng., B. & O., Cincinnati, Ohio.
Fenstermaker, D. C., Dist. Eng., C. M. & St. P. Ry., Chicago.
Giles, W. H., Asst. Eng., Mo. Pac., Poplar Bluff, Mo.
Gillen, U. E., Gen. Man., Toronto Term., Toronto, Ont., Can.
Hale, H. E., Group Eng., Pres. Conference Com., New York City.
Hayes, W. P., Asst. Eng., Mo. Pac., Monroe, La.
Holt, A. G., Asst. Ch. Eng., C. M. & St. P., Chicago.
Lane, E. G., Eng. M. Way, B. & O., Western Lines, Cincinnati, O.
Neptune, W. M., Prin. Asst. Eng., M. P., St. Louis, Mo.
Ringer, Frank, Chief Engr., M. K. & T., St. Louis, Mo.
Ritter, Adam, Arch., Sou., Western Lines, Cincinnati, Ohio.
Rogers, E. I., Roadmaster, I. C., Fort Dodge, Iowa.
Steinmayer, O. C., Supv. Timber Pres., St. L. & S. F., Springfield, Mo.
Thompson, F. W., Div. Eng., C. R. I. & P., Des Moines, Iowa.
Westcott, G. R., Asst. Eng., Mo. Pac., St. Louis, Mo.
White, R. C., Asst. Ch. Eng. Maint., M. P., St. Louis, Mo.

Guests

Burt, L. E., Motor Car Insp., R. I.
Clopton, Edw. J., Insp. M. of W., B. & O., Baltimore.
Elmore, P. W., Asst. Engr., B. & O., Seymour, Ind.
Hanson, L. J., Sig. Supr., G. T.. Montreal.
Hoff, C. P., Asst. Eng., A. T. & S. F., St. Louis, Mo.
Horton, U. D., West. Ry. Rep., Murphy Varnish Co., Chicago.
Lawrence, H. D., Danville, Ill.
Loftis, J. L., Roadmaster, Sibley, Iowa.
Lynch, H. A., Asst. Engr., B. & O., Wheeling, W. Va.
Mainds, J. S., Asst. Engr., G. T., Detroit.
McKenna, G. P., Supvr. of Track, B. & A., Worcester, Mass.
Purdy, J. W., Asst. Engr., B. & O., Chillicothe, Ohio.
Rinehart, E., M. of W. Insp., B. & O., Baltimore.
Robinson, H. H., Transitman, Santa Fe, Marceline, Mo.
Roush, E. M., Gen. Foreman, B. & B., A. T. & S. F., Armadillo, Texas.
Rowland, C. E., Toledo.
Snider, L. J., Transitman, A. T. & S. F., Marceline, Mo.
Scowden, A. B., Asst. Engr., B. & B., B. & O., Cincinnati, Ohio.

Canadian Pacific Engineers at Convention

Twenty-five officers of the Canadian Pacific, including J. M. R. Fairbairn, chief engineer, J. W. Orrock, principal assistant engineer, and P. B. Motley, engineer of bridges, were in attendance at the convention.

Educational Work Among Thomas A. Edison, Inc., Employees

A school has been started among the employees of the Thos. A. Edison Company, Inc., Primary Battery Division, which has been running for the last four weeks. Lectures are given by the different officers of the company each Thursday night. On the first two Thursday nights L. S. Dunham, reserve engineer lectured on primary battery electro-chemistry. On the next two Thursday evenings, William Shakespeare, works manager, lectured on manufacturing methods and control process. Lectures on other subjects which will be of interest and educational value to the employees will be given each week.

Progress on Chicago's New Station Project

THE CITY OF CHICAGO will soon have the distinction of participating in two passenger terminal projects of the first magnitude at one time. The first of these, the Union Station work, has been under way for several years, having been prosecuted actively during the season of 1919 and the present winter after having been virtually suspended for nearly two years during the war. The second project concerns the Illinois Central, which is about to launch an extensive reconstruction of its terminals, including an entirely new passenger station of monumental character and the eventual electrification of its operations within the city.

The Chicago Union Station

Work on the Chicago Union Station has now reached that period which comes in every large terminal project when superficial consideration conveys the impression that a large sum of money had been spent without making much progress. However, this impression is not justified by the actual facts. A large part of the preliminary work has been completed and while much of it is of a character that does not make an effective showing, it represents much real progress nevertheless.

Among the important features of the project coming under this classification is the work on the site of the station headhouse which comprises the entire block bounded by Canal, Clinton and Adams streets and Jackson boulevard. This entire block has been cleared of all the old buildings, and the basement excavation and all foundation work has been completed. The latter included the sinking of 250 open caissons (Chicago method) and the construction of a retaining wall around the entire site. The old Pennsylvania freight house which occupied a portion of the site of the proposed train concourse has been removed, making it possible to add two more tracks to the old passenger station layout, a measure which has done much to relieve congestion of traffic in the existing station. With the removal of these old buildings, it has also been possible to proceed with the construction of a concrete retaining wall along the river, a difficult and expensive piece of work which has been completed between Monroe and Adams streets and is now actively in progress between Adams street and Jackson boulevard.

South of the station practically all of the obstructions to the reconstruction of the south approach have been removed. This approach will be enlarged from four tracks to six tracks and placed on a new grade some three or four feet below the old one, for the entire distance between Van Buren street and Roosevelt Road (Twelfth street). This track work has been in progress for some time south of Harrison street and a considerable portion of the new track is now in place. The reconstruction of the street viaducts over the tracks is being carried on simultaneously with this work. The Taylor street structure which flanks the south end of the new Pennsylvania freight house has been completed and will be opened within a week. Work is now in progress on both the Polk street and Harrison street viaducts. The old structure at Harrison street, which consists of a series of through truss spans, has been shifted laterally so that it can continue to carry the street traffic while one half of the new structure is being erected.

North of the station where a four-track approach is to replace the now inadequate two-track main line, it is necessary to raze two large warehouses belonging to Butler Brothers. To accomplish this, the Union Station Company has been required to furnish this firm with a new 14-story building with ground dimensions of 151 ft. by 382 ft., or an area of about 58,000 sq. ft. This building, which faces on Canal street between Washington and Randolph streets, is now in process of construction. The structural steel frame is in place and work of the other trades is well along.

The Illinois Central Project

The long period of negotiations between the Illinois Central and the several governmental bodies involved in the approval of its plan for the reconstruction of its facilities was finally consummated in the approval by the United States War Department of an extensive Chicago lake front improvement project which is directly related to the work contemplated by the railroad. The relations between the railroad covering its terminal improvements, the South Park Board with respect to the proposed lake front park system and the City of Chicago in connection with a contemplated municipal harbor development entailed many complications, but an agreement between these three parties was reached satisfactorily in July, 1919. However, the United States War Department, having supervision over the submerged lands in the lake which the project contemplates filling, withheld its approval of the plan until February 20 of this year.

The completion of this project will do much to enhance the appearance of Chicago's front yard, including that portion to be seen from the Congress Hotel. The old Illinois Central station will be removed and replaced by a great new structure of classic outline on a new site to the south of the old one a sufficient distance to permit Roosevelt Road to pass in front of the building and across the tracks on a wide viaduct. The facilities of the Illinois Central south of this station will be virtually rebuilt, the principal change being an appreciable widening of the trackage space, which will also be depressed so that several viaducts may be carried across the tracks for direct communication between the city streets and the proposed lake front park.

One of the most important features of the project is the provision for electrification. Under the agreement the Illinois Central is required to start the construction of facilities necessary for electrification within two years, and to institute the electric operation of all of its suburban trains within seven years, of its freight operations north of Roosevelt Road within 10 years, all of its freight service within the city within 15 years, and of all passenger service within 20 years.

It is of no little interest to members of the American Railway Engineering Association that Past-president A. S. Baldwin has been placed in entire charge of the Illinois Central terminal improvements with the title of vice-president.

Maintenance Painters Confer

The Executive Committee of the Maintenance of Way Master Painters' Association held a meeting in Chicago Wednesday morning for the purpose of perfecting plans for the next convention of this association, which will be held at Detroit, Mich, October 5-7.

Changes on the A. & W. P. and A. B. & A.

The office of signal engineer on the Atlanta & West Point has been abolished and E. H. Pudney, former signal engineer, has been appointed electrical and signal engineer of the Atlanta, Birmingham & Atlantic, with office in Atlanta, Ga. Mr. Cassedy, signal supervisor on the Atlanta & West Point, with headquarters at Lagrange, Ga., will have charge of all signal work on the Atlanta & West Point, reporting to O. T. Nelson, chief engineer.

A Memoir—Albert J. Himes

THE COMMITTEE on Iron and Steel Structures tendered a fitting tribute to the memory of the late Albert J. Himes, long a member of that body and a most active participant in the association's affairs which we present below:

"The committee records with deep regret the death on November 4, 1919, of Albert J. Himes, who was for five years its chairman.

"The years of Mr. Himes' connection with the committee as member and as chairman were years of progress and accomplishment. He became a member in 1906, was made chairman in 1912, and resigned that position in 1917. He participated actively in the preparation of the General Specifications for Steel Railway Bridges which have been of wide usefulness throughout the world. The later work of the committee on the subjects of clearances, rating of existing bridges, specifications for erection, rules for inspection of steel bridges, and other important matters, bear the marks of his energy and clearness of mind.

"Mr. Hines' professional work was characterized by serious application and systematic thinking. His personal qualities were such as to endear him in a peculiarly intimate way to all those whose work threw them in contact with him. His fund of interesting happenings in engineering work was drawn on constantly to give point to the discussions, and this trait was made good use of in the committee proceedings."

Back to Our Owners Again

WE ARE BACK WITH our overworked engines, our rolling stock battered and worn,
Our tracks somewhat out of alignment, our rights-of-way weedy and torn;
The management's all shot to pieces, the personnel gloomy or mad,
But in spite of our rocky condition much comfort is still to be had.

Back to our owners again, Uncle,
Back to our owners again,
Don't look so black, for it's good to be back,
Back to our owners again.

When the Kaiser ignored all his signals, the President said "Okeh,
You may henceforth manage the railroads in your most efficient way
As you did on the Tunnelville trolley (and you pleased the public too),
Then the world shall acclaim your greatness, dear William G. McAdoo."

Back to our owners again, Uncle,
Back to our owners again.
We were fond of dear Mac, but we'd rather be back,
Back to our owners again.

One man filling many positions thrust into the railroad game
With the wealth of the Nation behind him, he wasn't so much to blame
If he scrambled the roads unduly in his search for a great ideal,
Yet we carried the food and the fighters, delivered the fuel and steel.

Back to our owners again, Uncle,
Back to our owners again.
The foe has been licked and we have kicked
Back to our owners again.

The public asked no questions, it wanted to win the war.
It swallowed our standardized dinners, it grinned where it used to roar.
It cheerfully slept in an upper or sat in the coach all night,
And purchased our full-priced mileage to help us finance the fight.

Back to our owners again, Uncle,
Back to our owners again.
Those dinners *were* punk, and that upper bunk!
Back to our owners again.

The Senate tried to amend us, the House took a hand in the show.
The plumbers wanted to buy us (the public to furnish the dough),
Nine hundred and ninety committees, the Interstate Commerce and Hines,
The B. of L. E., Stone, Gompers and Lee reformed us on various lines.

Back to our owners again, Uncle,
Back to our owners again.
Ready to tackle the job, Uncle,
Eager the goal to attain.

What are you?

Some talents too good to be lost you
American Genius and Grit.
Two things that'll pay what they cost you
If you give them a chance to remit.
You have hampered the growth of the railroads,
Turn around now and help them regain
The strength that they should for America's good
Now they're back to their owners again.

With apologies to Rudyard Kipling—J. S. H.

A. M. Burt Returns to Northern Pacific

A. M. Burt, assistant director, division of operation, United States Railroad Administration, in charge of maintenance and engineering, and chairman of the automatic train control committee, has been appointed assistant to the operating vice-president of the Northern Pacific. Prior to federal control Mr. Burt was general manager of the Northern Pacific. In the reorganization incident to the taking over the roads by the government, he was made assistant general manager. His appointment as assistant director of the division of operation was dated June 1, 1919.

A. W. P. A. Meeting

The executive committee of the American Wood Preservers' Association met in all-day session at the Hotel Sherman, Thursday, March 18. Among other subjects which were considered was the selection of the personnel of committees for the ensuing year.

St. Paul Men Attend the Exhibit

Among the 90 officers and foremen of the Chicago, Milwaukee & St. Paul who, with Chief Engineer C. F. Loweth, attended the convention and exhibit, were a number of the 50 out-of-town members who came from far western divisions.

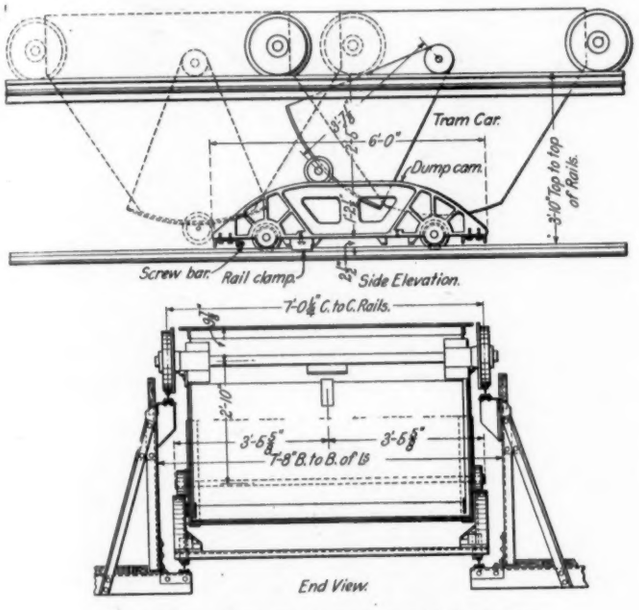
Organization Change on Southern

Effective on March 1, W. J. Eck, superintendent, signal and electrical department, Southern Railway System, will report direct to the assistant to the vice-president instead of to the chief engineer as heretofore.

An Improved Tram Car for Coaling Stations

AMONG THE NEW DEVICES brought out during the past month to facilitate coaling station operation is an automatic dumping tram car manufactured by the Roberts & Schaefer Company, Chicago, for use in locomotive coaling plants of 600 tons or more capacity. This type of car is now in use on the Pennsylvania Lines West at Columbus, Ohio, on the Norfolk & Western at Roanoke, Va., and on the Lehigh Valley at Ashmore, Pa.

The tram car which has a three-ton capacity is constructed of steel and is carried on four cast iron wheels 16 in. in diameter placed above the center of gravity of the car as an insurance against its jumping the track. The body of the car is 6 ft. wide and 6 ft. 6 in. long for a depth of approximately 14 in., after which the two ends



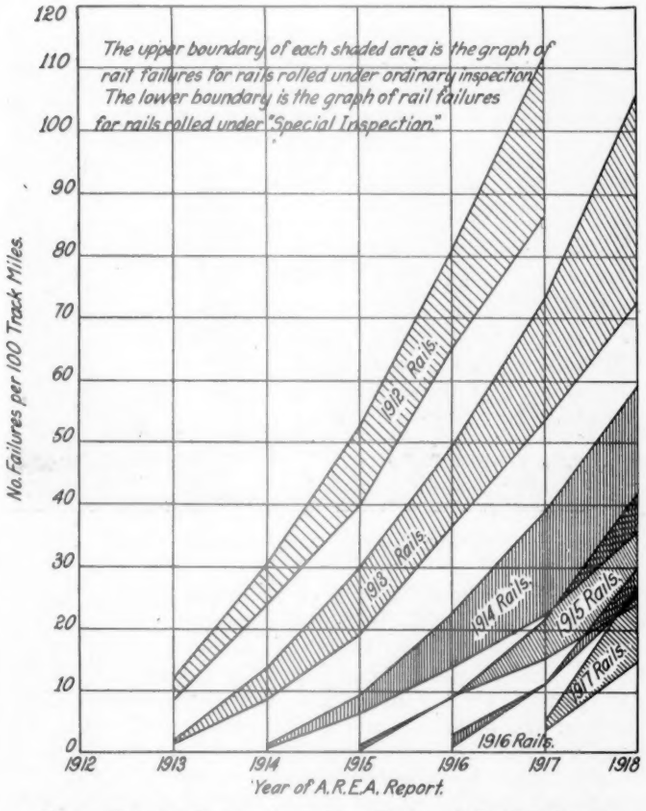
The Tram Car and Dumping Mechanism

slope in towards the discharge opening, which measures approximately 2½ ft. by 6 ft. This opening is closed by a pendulum swing gate with a radius of 3 ft. 5 in., which is of the undercut type carrying two 6-in. rollers. The car operates on a 6 ft. 10 in. gage track laid with 30-lb. rail extending across the top of the coaling pocket and is hauled horizontally over this track by a ½-in. cable which is connected to the same drum that hoists the elevating bucket. This synchronizing of the bucket and the tram car renders it certain that the car will always be under the discharge chute when the elevating bucket reaches the top. As the bucket descends the cars moves across the track, reaching the far side when the bucket is at its lower level and returning when it is elevated.

The coal is dumped at any desired point by means of a traveling cam which engages the rollers of the swing gate on the tram car. This cam consists of a skeleton frame casting, carried on four 6-in. rollers, running on 30 lb. rail with a gage of 6 ft. 5 in. at a distance of 3 ft. 10 in. below the tram car rails. At the start of the operation the tram car is allowed to push the cam casting along its track until the desired point is reached, when the entire operation is stopped and the casting clamped to the rails by means of a double clamp actuated by a long screw bar extending across the frame and a removable lever. After this is completed, the movement is again started and as the tram car meets the casting the rollers on the swing gate run up the inclined face of the casting, opening the door and discharging the coal. While the roller is traveling over the horizontal portion of the cam the door is held open and as the car continues, the rollers run down the other incline, silently closing it. On the return trip to the discharge chute, the gate is again opened and closed, the car receiving a second discharge over the same spot, an advantage where sticky coal is used, before returning for another load from the elevating bucket. This operation is continued until sufficient coal has been dumped in one place.

Rail Statistics Demonstrate Value of Special Inspection

THE RAIL STATISTICS COMPILED by the American Railway Engineering Association have previously afforded some definite data regarding the specific benefit to be derived from the manufacture of rail under the system of "special inspection" originated and conducted by Robert W. Hunt & Company, Chicago. A description of this inspection and some data on the results secured were published in the *Railway Age* of March 20, 1919, page 744. With the gradual accumulation of the rail statistics, especially those showing the influences of



How "Special Inspection" Has Reduced Rail Failures

the disturbing conditions of the war period, this demonstration can be carried even further, as is illustrated in the diagram which shows the relation of rail features to the "special inspection" graphically.

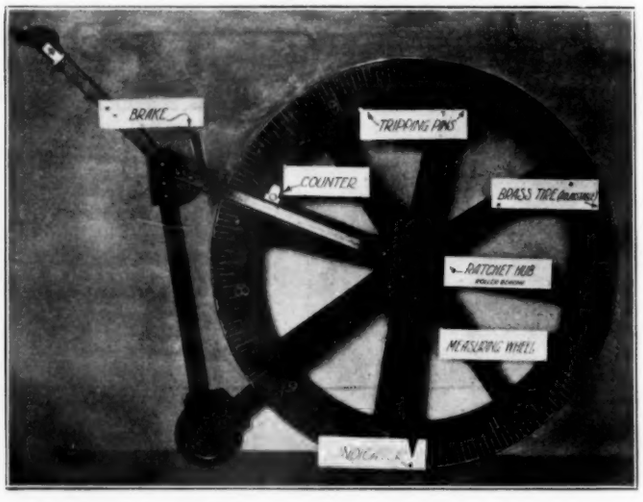
This chart shows the number of rail failures per 100 miles of track for all rail rollings reported to the American Railway Engineering Association as subdivided between those from rails that received the special inspection and those that were rolled without this supervision. The shaded area between the two curves for each year's

rolling gives a measure of reduction in failures per 100 miles of track each year. One fact brought out by a study of the diagram is that the proportionate benefit to be derived from this service has not decreased during the general improvement in the manufacture of rails taking place in the last six or seven years. In fact, the proportionate reduction in failures has been even greater for some of the more recent rollings than for those of earlier years.

A New Method for Making Track Measurements

THE WARREN-KNIGHT COMPANY, Philadelphia, Pa., has recently developed a device known as the Sterling trackometer for the purpose of measuring longitudinal distances, particularly along tracks. It consists essentially of a built-up hardwood measuring wheel equipped with roller bearings and an adjustable brass tire having a true circumference of 10 ft., which is calibrated in feet and tenths. A strip of rubber inserted between the tire and the wheel felloes furnishes the necessary resilience in adjusting the circumference.

The operating handle of the device is hinged in the frame in such a way that it is impossible to raise the measuring wheel off the rail head by bearing down on the



The Sterling Trackometer

handle while it is in use. A small cast-iron trailer wheel assists in guiding the instrument along the head of the rail. A positive hand brake is provided which, when locked, enables the trackometer to be removed from the rail quickly, a mark being first made on the rail at the point of the indicator as a guide for resetting when the measurements are to be continued. A counter mounted on the frame records the distance traveled in feet, the fractional parts of a foot being read off the measuring wheel by the aid of the indicator pointer.

The use of the trackometer, which is adaptable to track work, both tangent and special, chainage, pavement measurements, yardages and land measurements where the land is practically level, requires a two-man party where rapid movement is desired, one man operating the instrument and the other making and recording the readings.

Results of tests by valuation and roading engineers have shown that measurements obtained with the trackometer are as accurate as those obtained with the 100-ft. steel tape and that its use eliminates the danger of "dropping a station" or the errors introduced through reading the tape backwards, using a repaired tape, etc.

Improved Mercury Time Release

THE UNION SWITCH & SIGNAL COMPANY, Swissvale, Pa., has improved its mercury time release so that an increase in the upward pressure of the latch is obtained. This release is usually applied to signal levers of Union power interlocking machines, in the same manner as an ordinary indication magnet. The mercury actuated lock introduces a safe time interval before the indication of a signal lever may be taken up, thus preventing

The Mercury Slow Release

a quick change in the route should the engineer of a train fail to note that the signal has been returned to the stop position after it had been cleared. Some of the features of this release consist of an external adjustment of the time element between 5 and 45 sec.; all parts that come in contact with the mercury are immune to its effects; there is ample provision to prevent the mercury from leaking out around the threads and joints, and contacts may be provided for closing circuits in either or both positions of the plunger.

EDITORIAL

Railway Age

The Table of Contents Will Be Found on Page 5 of the Advertising Section

An article in this issue describes the unusual features of an engine terminal and yard built by the Denver & Rio Grande at Soldier Summit, Utah, to meet the requirements of a disadvantageous site. Because the conditions did not permit of the use of a conventional layout, resort was had to some original designing with highly commendable results. One of the features, a rectangular engine house affording space for 24 locomotives, may be open to objections by some students of this subject in spite of the waste of space in roundhouses built long enough to accommodate Mallet locomotives and the difficulty of keeping turntables in operation in localities subject to extremely heavy snow fall. However, in view of the frequency with which the idea of a rectangular house has been raised, it is certain that this departure from the conventional shape will be watched with a great deal of interest. But these are matters of detail; the real story in the account of this new terminal lies in the facts that led to its construction. Ever since the four per cent grade on the west approach to Soldier Summit was eliminated, operating conditions have pointed to the advantages of a further improvement through the transfer of the engine terminal to the summit from Helper, 25 miles down the east slope. How much this change has facilitated the handling of traffic is described in the article. It affords an illuminating example of the possibilities for profitable improvements that do not in themselves increase tonnage ratings or track capacities, but which nevertheless exert an enormous influence on the traffic-handling capacity of a line. Unquestionably, there are many other opportunities for just such improvements on American railroads.

The Opportunities Are Many

Daylight saving plans in New York, New England and New Jersey are in a very unsettled state, and nearly everybody (including most of the railroads) seems inclined to wait and see what is going to be done by others. As we go to press the legislatures of Massachusetts and New Jersey are still discussing various proposals, though all interests desire to make the change, if change is made, only three days hence. In New York (except in federal government establishments and the railroad stations) the question is settled, and the sixtieth degree standard will go into effect at 2 o'clock Sunday morning. As noted last week, the New York, New Haven & Hartford will issue new schedules for suburban trains, and the New York Central has decided to do the same. The other roads are still waiting to see if all the commuters really do set out for their offices an hour earlier than at present. So far as can be judged by the experience of Canada last year the willing and the unwilling will to a large extent adopt the same habits, and without much delay. For example, take the case of New York City. The city government has decreed for the summer the standard of the 60th meridian. A suburban resident working in the city leaving home at 8 a. m. will start at 7, but will call it 8. The railroads, being subject to the federal law, which now requires them to use normal time the year round, will not change clocks, but will change trains, issuing a new timetable and starting the eight o'clock train at seven; and calling it seven. The suburban passenger may call it eight, if he chooses, but it will be seven and the railroad will call it seven. The federal government offices and the railroad stations will keep their clocks at the 75th meridian, but if general business starts an hour earlier the post offices, the courts and the railroad offices will without doubt find it to the advantage of all concerned to start with them. In Eastern Canada "summer time" (60th meridian) was generally in vogue in 1919 in spite of the refusal of the government to adopt it by statute. The railroads, acting on their own responsibility, changed their clocks so as to avoid confusion at their connections with railroads in the States and the large cities made the change by ordinance; even the House of Parliament at Ottawa changed their clocks. The legislators had fixed the law to suit the farmers, but in arranging their own workday they found it expedient to conform to the customs of their immediate neighbors. In New York, now, the railroads cannot change their clocks, but they can change their habits.

"Summer Time" in New York and Elsewhere

The manner in which the purchases and inquiries for locomotives have kept up during the past few weeks is an encouraging indication for a good year for the railway supply manufacturers. The orders and inquiries are both being reported in considerable quantities and those who are following developments are getting no small encouragement from the fact that nearly all the inquiries are proving to result in orders. The sentiment thus expressed is borne out in an interesting way in the annual reports of the various railway equipment concerns, none of which fail to mention their opinion that 1920 is going to prove a good year because of the purchasing expected to accompany the return of the railroads to private control. The feeling on all sides is optimistic. In view of the fact that a great many of the roads—particularly some of the larger ones—have not yet been included in the list of locomotive purchasers, its is apparent that continuation of the orders is to be expected for a considerable period in the future. An interesting side-light on the matter may be obtained from a comparison of the locomotive purchases this year with those for 1917, 1916 and 1915. The comparative totals are given up to the third week in March as follows:

Purchase of Locomotives

DOMESTIC

	1920	1917	1916	1915
January	32	157	231	31
February	383	623	272	36
March (three weeks)	220	268	423	107
Total to end of third week	635	1,048	926	174

FOREIGN

	1920	1917	1916	1915
January	209	268	2	7
February	86	98	129	117
March (three weeks)	80	4	386	0
Total to end of third week	375	370	517	124

From this table it will be observed that the domestic orders thus far this year total 635 as compared with 1048 in 1917, 926 in 1916 and 174 in 1915. This means, of course, that the volume of business this year, from the standpoint of number of locomotives ordered, has not been as great as in 1917 or 1916. It can also be taken to mean, in view of the un-